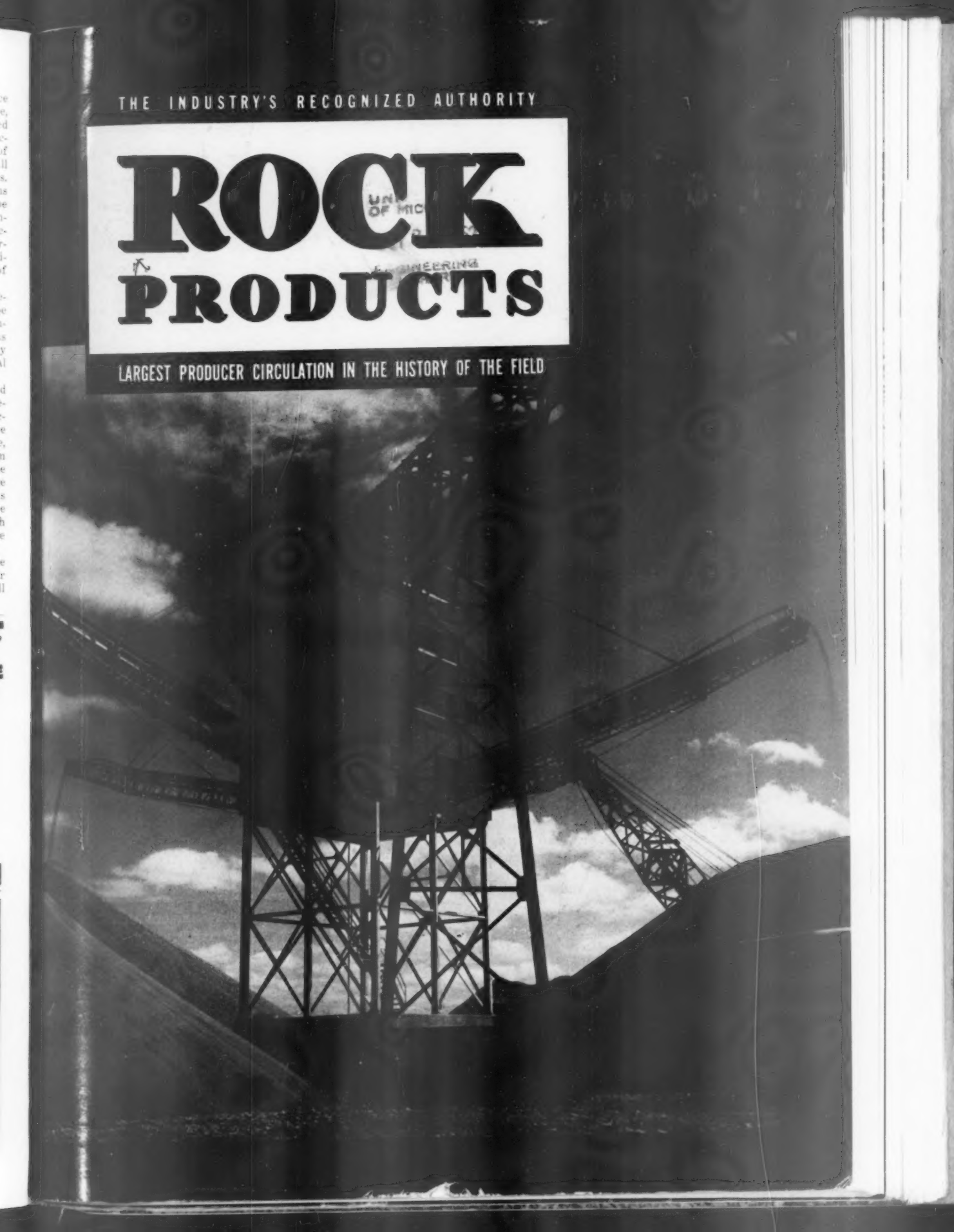

THE INDUSTRY'S RECOGNIZED AUTHORITY
ROCK
PRODUCTS
LARGEST PRODUCER CIRCULATION IN THE HISTORY OF THE FIELD

UNIVERSITY OF MICHIGAN LIBRARIES

Investigate

THE IMPROVED McLANAHAN

Bantam Buster

SINGLE ROLL CRUSHER

WITH CUT FABRICATED STEEL FRAME GEARS, ANTI-FRICTION ROLLER BEARINGS, SEGMENT ROLLS AND RENEWABLE CRUSHING PLATE TIPS

for Crushing

Coke, Lime, Coal, Salt, Alum and Similar Materials

For low initial cost and exceptional economy of operation, standardize on the McLanahan Bantam Buster Crusher. With its high ratio of reduction and rugged construction throughout, it produces a constantly uniform product of desired size—from ¾″ up for market requirements.

In operation, the material to be crushed is fed into the hopper where high teeth on the roll crack the large lumps and low teeth break the smaller pieces to required sizes. These crushers are available in three basic sizes: 18″ in diameter up to 48″ wide, and 24″ and 30″ in diameter up to 60″ wide.

The Bantam Buster can be choke fed through a hopper . . . or used in conjunction with a McLanahan Reciprocating Plate Feeder.

Write for your copy of Bulletin BB-5112 Today!

This new bulletin includes technical details, dimensional drawings and a table showing capacity-horsepower data for the various roll lengths and various size products.

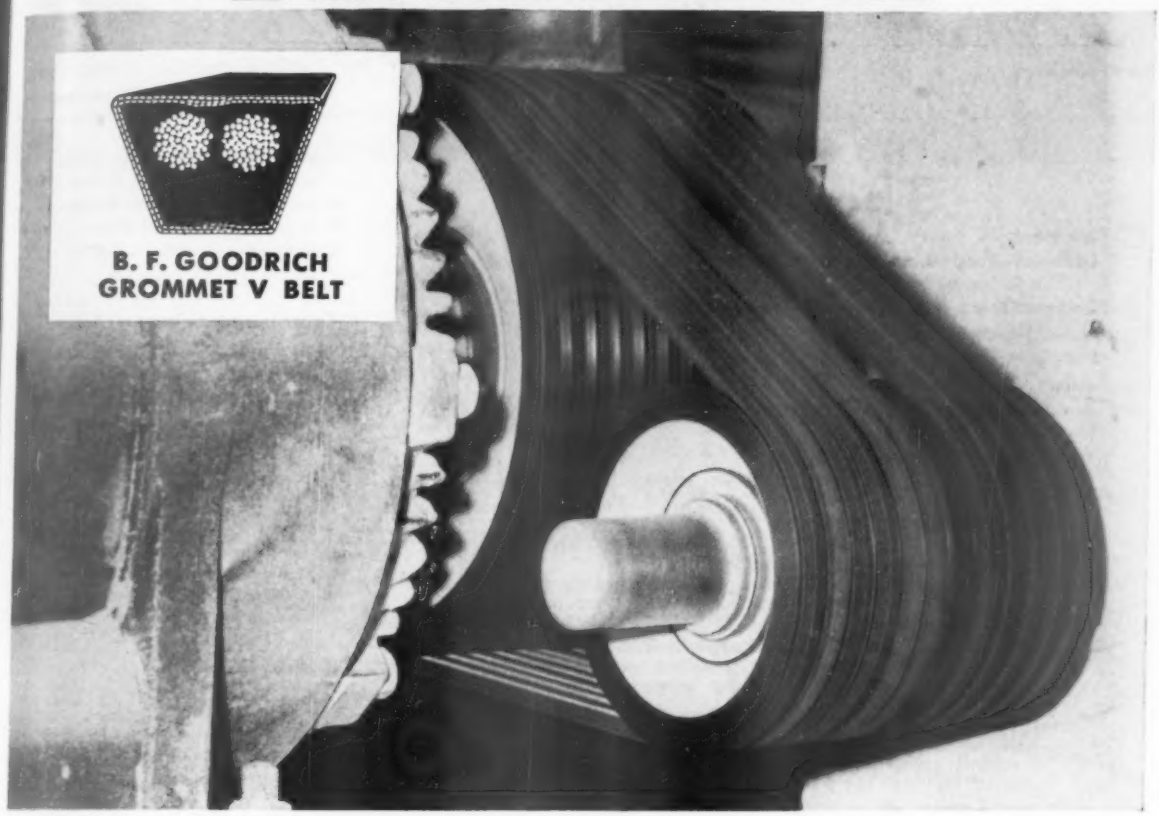
McLANAHAN & STONE CORPORATION

Pit, Mine and Quarry Equipment Headquarters Since 1835

Hollidaysburg, Pennsylvania

Dependable Products: Single and Double Roll—and Jaw Crushers, Crushing Plants, Reciprocating Plate and Apron Feeders, Rail Grizzlies, Conveyors, Elevators, Screens, Scrubbers, Steel Log Washers, Sand Dregs, Hoists, Jigs, Dry Pans, Dryers, Scrap Sandlers, Pulleys, Gears, Bearings, Sprockets, Sheaves, Rollers, Bin Gates, Elevator Buckets, Gratings, Car Wheels, Ferrous and Bronze Castings.

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER



Where B.F.Goodrich grommet belts outlasted others 3 to 1

B.F.Goodrich grommet V belts cut costs 20 to 50%

ORDINARY belts, previously used on this drive, couldn't stand the heavy load, couldn't take the strain of 24-hour-a-day service. There were frequent shutdowns for repairs. Belts were averaging only 3 months' life. Then B.F.Goodrich grommet V belts were installed. When the picture was taken, the grommet belts had already outlasted ordinary belts 3 to 1, maintenance costs had been cut nearly 100%, and the belts still looked good for a lot more service. Here's why:

No cord ends — A grommet is endless, made by winding heavy cord on itself to form an endless loop. It has no overlapping ends. Because most of the failures in ordinary V belts occur in the region where cords overlap, the endless cord section in a grommet V belt eliminates such failures.

Concentrated cord strength — All of the cord material in a B. F. Goodrich grommet belt is *concentrated* in twin grommets, positioned close to the driving faces of the pulley. There are no layers of cords to rub against one another and generate heat; cord and adhesion failures are reduced. And grommet V belts stretch less — only ⅓ as much, on an average, as ordinary V belts.

Better grip, less slip — Grommet V belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give ⅓ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip, there is also less surface wear.

They cost no more — Grommet V belts cut costs because they last longer, increase production because machines keep running with fewer interruptions, reduce maintenance costs because they need less attention, yet they cost not one cent more. Available in C, D, and E sections. But remember, only B. F. Goodrich makes the grommet V belt (U. S. Patent No. 2,233,294), so to get all these savings, call in your local BFG distributor the next time you need V belts, or write *The B.F.Goodrich Company, Industrial & General Products Div., Akron, Ohio.* (Available in Canada)

Grommet V-Belts BY
B.F.Goodrich
FIRST IN RUBBER

ABC

ROCK PRODUCTS

OCTOBER, 1952 THE INDUSTRY'S RECOGNIZED AUTHORITY VOL. 55, No. 10

Bror Nordberg
Editor

Nathan C. Rockwood
Editorial Consultant

This Month

We Hear 33

Editorial—Producers of Aggregates Have a Stake in Airport Planning 67

Rocky's Notes—The Shadow of Things to Come 69

Labor Relations Trends 71

People in the News 73

Industry News 77

Hints and Helps 80

New Machinery 82

More Cement for Detroit Market 84
Peerless Cement Corp. increases clinker production at Port Huron for grinding in Detroit *Bror Nordberg*

Survey of Liming Materials Use 90
Robert S. Boynton

Gravel Plant Designed for Ground Storage 93
Consolidated Sand and Gravel, Ltd., segregates production from loading operations for simplified large capacity plant *J. T. Mogan*

Relation of Ball Load to Clinker Charge in Grinding Mills 96
Laboratory tests in clinker grinding suggest need for redesign of mills for lower power requirement *R. A. Loveland*

Underground Mining of Cement Rock 100
Coplay Cement Manufacturing Co.'s mine being developed using tungsten carbide bits and millisecond delay blasting *A. F. Rambosek*

Calcining Cement Slurry on Continuous Conveyor Grate 102
Review of technical developments in the design and use of sinter-grate kilns in Europe *B. M. Pearson*

Depletion Necessitates Long Rail Haul 105
Rio Grande City, Texas, plant of Fordyce Gravel Co. ships finished product almost 50 miles since exhaustion of nearby deposits *Walter B. Lenhart*

Crushing Practice and Theory 107
Part XI. Crusher product curves and tables *Brownell McGrew*

Cellular Calcium Silicate Products 110
Pre-formed foamed concrete products suggest new market potentials *S. Dilnot*

Engineers Discuss Nonmetallic Minerals in Chicago Area 118
Industrial Minerals Division of A.I.M.E. features reports on silica mining, water transportation and building materials

Cement Research in Japan 122

Planning for Profits 189
A producer views the ready-mixed concrete business—Part I *James A. Nicholson*

Heating Aggregates in Bins 193
Suggested method of heating coils would replace present systems where steam is injected directly onto frozen aggregate *William J. Shore*

Blending Aggregates for Concrete Units 195
Lightweight aggregate blended with sand and gravel by belt system in Shelby Concrete Products' North Carolina plant *Walter B. Lenhart*

Small Capacity Plant Uses Autoclave Steam Curing 196
Arkhola Sand & Gravel Co. uses two 80-ft. autoclaves to speed up curing of masonry units in one-machine plant *Walter B. Lenhart*

A.C.I. Emphasizes Prestressed Concrete 198
Chicago regional meeting devotes major share of program to U.S. progress in prestressing

Walter B. Lenhart, Associate Editor
L. David Minsk, Associate Editor
Robert E. Wilde, Associate Editor
M. K. Smith, Assistant Editor
E. M. Amacher, Assistant Editor

Contributing Editors

Victor J. Azbe
F. O. Anderegg
M. W. Loving
James A. Barr, Jr.

Home Office

E. R. Gauley, Manager
Mary A. Whalen, Subscription Dir.
C. M. Hancock, Production Manager
C. P. Teats, Field Representative

District Offices

Eastern Area—Morgan K. Cottingham, Manager; Raymond E. Keine, Assistant, 522 Fifth Ave., New York 36, Tel. Murray Hill 2-7888.

Central Area—R. P. Keine, Manager, Hanna Bldg., Cleveland 15, Tel. Main 1-4362.

Midwest Area—E. H. Hickey, Representative, 309 W. Jackson Blvd., Chicago 6, Tel. Harrison 7-7890.

Western Area—L. C. Thaon, Manager, 309 West Jackson Blvd., Chicago 6, Tel. Harrison 7-7890.

Pacific Area—Duncan Scott & Co., Mills Bldg., San Francisco 4, Tel. Garfield 1-7950. In Los Angeles 5, 2978 Wilshire Blvd., Tel. Dunkirk 8-4151.

London, England—Harold F. Charles, Managing Director, Maclean-Hunter, Ltd., Wellington House, 125 Strand, London, W.C. 2.

ROCK PRODUCTS is published monthly by MACLEAN-HUNTER Publishing Corporation, 309 West Jackson Blvd., Chicago 6, Illinois; Horace T. Hunter, President; E. R. Gauley, Vice-President; Ralph K. Davis, Secretary. Copyright, 1952. Entered as second-class matter, Jan. 30, 1936, at the Chicago, Ill. post office under the act of Mar. 3, 1879. Additional entry at Long Prairie, Minn. ROCK PRODUCTS is indexed regularly by Engineering Index, Inc. and the Industrial Arts Index.

SUBSCRIPTION INFORMATION

Subscription Price: United States and Possessions, Canada one year, $2.00; two years, $3.00; three years, $4.00. Pan American, one year, $4.00; two years, $7.00; three years, $10.00. All other foreign one year, $8.00; two years, $12.00; three years, $15.00. Twenty-five cents for single copies. Canadian subscriptions and remittances may be sent in Canadian funds to ROCK PRODUCTS, P. O. Box 100, Terminal "A," Toronto, Canada.

To Subscribers—Date on wrapper indicates issue with which your subscription expires. . . In writing to have address changed, give old as well as new address.

UNIVERSITY OF MICHIGAN LIBRARIES

"WE HEAR..."

October, 1952

Eighteen raw materials used in defense production were recently added to the list of those exempted from renegotiation. These materials are natural and portland cements; lime, including quicklime; rare earth minerals; lump talc; film mica; sodium; metallic titanium; metallic zirconium; nickel metal powder; liquidated antimony; natural tar; metallic cadmium; unrefined copper anodes; germanium chloride and germanium oxide; iron pyrites in ores and concentrates; dimension stone; and metallic manganese.

* * * * * * * * * *

Aluminum production for the first six months of 1952 amounted to 923,000,000 lb., or 14½ percent higher than the output for the corresponding six months of 1951, and 17 percent higher than the same six months of 1943, the top production year of World War II.

* * * * * * * * * *

A drive to crack down on steel users violating the new restrictions placed on steel inventories is being launched by the National Production Authority. The agency's enforcement officials in the field are being assisted by "flying squads" from Washington in checking steel stocks of manufacturers against their present orders now placed with steel producers. In early August, N.P.A. slashed permitted steel inventories of manufacturing companies from a 45-day supply to a 30-day supply. The order is expected to remain effective for at least the rest of this year.

* * * * * * * * * *

A total of $73,123,400 has been appropriated to the Bonneville Power Administration for the new fiscal year, beginning last July 1, for construction and maintenance of key transmission facilities in the Northwest. The appropriation provides $66,523,000 for construction and the balance for operations and maintenance. New construction planned includes two new major 230,000-volt grid lines from Chief Joseph dam in northwest Washington; a 115,000-volt transmission line and substations for service to the Tillamook county, Ore., area from Forest Grove; a short interconnecting transmission line to integrate Albeni Falls dam with the Columbia river grid; and Lookout Point Alvey line No. 2 and substation.

* * * * * * * * * *

A national mortgage investment firm recently revealed it has received an unusually high amount of loan requests from builders of office buildings and commercial structures, indicating that there will be more of that type of construction throughout the United States in the near future. The trend toward increased office building activity was said to be particularly noticeable in such major cities as Atlanta, Chicago, Cleveland, Denver, Kansas City, Los Angeles, New Orleans, New York, Philadelphia, San Francisco, St. Louis and Seattle. The reason for the trend is believed to be due chiefly to the fact that many of the major industrial firms of the country have found through experience that their rate of labor turnover and cost of labor have decreased when they moved into more modern air-conditioned office building structures.

* * * * * * * * * *

The President's Materials Policy Commission, after extensive study of the nation's resources, warned the U.S. of approaching materials shortages. According to the report, in less than 40 years, the U.S. has used more of almost every metal and mineral fuel than the entire world used in the preceding centuries. The commission doesn't predict a sudden depletion of U.S. basic raw materials, but states that rising costs of these materials, due to scarcity, could undermine our standard of living. The commission recommended elimination of protective tariffs, support of research by government and tax law revisions which would encourage conservation.

WE HEAR

A proposed 8 percent increase in motor carrier freight rates in the Midwest has been temporarily blocked by the Interstate Commerce Commission. The increase had been scheduled to go into effect in July, under a 30-day public notice issued by the Middle West Motor Freight Bureau. The I.C.C., however, issued a suspension order directing the truckers not to increase their rates until an investigation could be made and hearings held.

* * * * * * * * * *

The Office of Price Stabilization recently announced that, effective as of July 21, 1952, sales of fertilizer to farmers will be considered retail sales instead of wholesale transactions, as they had been prior to that date. A price official predicted that this may raise ceiling prices somewhat, but added that sellers who gave special prices to farmers during the base period must continue to do so, as required by Amendment 32 to the General Ceiling Price Regulation.

* * * * * * * * * *

The recent steel price increase and higher labor rates have resulted in increased construction costs, according to Engineering News-Record's Construction Cost Index, which jumped to 585.19 in August (using the 1913 index as equaling 100). The August rate was 2.5 percent higher than in July and 7.8 percent above August, 1951. The increase from August, 1951, to August, 1952, was almost double the rate of increase from August, 1950, to August, 1951. Engineering News-Record's Building Cost Index (1913 equals 100) rose to 423.86 in August, which was a 2.2 percent increase over July, and an increase of 5.9 percent over August, 1951.

* * * * * * * * * *

A new N.P.A. "automatic" allotment procedure, which becomes effective next January 1, will reduce by half the number of manufacturing firms which now must apply each quarter for steel, copper and aluminum allocations. The revised system will leave only 10,000-12,000 companies which will still be required to apply directly to N.P.A. for their metal requirements. When the Controlled Materials Plan first became effective, appoximately 50,000 manufacturers were required to file applications for metal allotments.

* * * * * * * * * *

Recent blasting operations at a stone quarry near Columbia, Mo., were said to have caused damage to a house about a half-mile distant. A large rock, about the size of a football, allegedly struck and splintered the porch and jarred nails loose from one of the porch's corner posts.

* * * * * * * * * *

It is expected that O.P.S. will soon issue a regulation allowing manufacturing firms to boost their ceiling prices to reflect 100 percent of the recent cost increases of steel, copper and aluminum. O.P.S. had previously indicated that manufacturers would only be allowed to pass along 40 to 60 percent of cost increases, with the manufacturers absorbing the rest. It is also possible that manufacturers may be permitted to reflect higher transportation cost and wage increases in their new ceiling prices.

* * * * * * * * * *

The development of a new synthetic product for agricultural use, which binds the soil particles into aggregates, enhancing aeration and moisture retention, has been announced by Arthur D. Little, Inc., Cambridge, Mass. The negatively charged particles of the compound are said to serve as links between the positively charged soil particles, bonding them together. While the material is not a fertilizer, its use is said to prevent the soil from becoming heavy and sticky when wet, or dusty and hard when dry, and so can increase crop yields on poor soils. By stabilizing the soil against the impact of rain or running surface water, the product is also said to be useful in controlling soil erosion. Mixed with grass seed, it forms a film which will hold the soil until the grass roots become established.

* * * * * * * * * *

Heavy construction awards, nationally, totaled $10,949,892,000 for the first 34 weeks of 1952, compared with $9,549,903,000 for the corresponding period of 1951, as reported by Engineering News-Record. Private mass-housing awards continue high, totaling $1,976,200,000 for the 34-week period, or 55 percent above the comparable period of 1951.

THE EDITORS

UNIVERSITY OF MICHIGAN LIBRARIES

Producers of aggregates have a stake in airport planning

EFFORTS ARE BEING MADE through national organizations to develop a pattern to govern the location of airports which will accelerate the development of transport aviation. These organizations all recognize that one of the greatest hindrances to growth of commercial aviation has been the inadequacy of roads from airports into the cities they serve and those serving the general area around major cities.

The committee on access roads to airports, of the American Road Builders' Association, has come out with a report on the influence of close-in airports on city-to-airport travel costs which shows that a much more expensive over-all development close-in to a city might be justified by savings to airport users over the life of an airport. The report emphasizes that modern highways to airports, regardless of the distance factor, result in substantial time savings plus dollars saved and stresses the saving of time as being of greatest importance.

There are other factors of more importance in the establishment of an airport than savings of time and money to the users, as the report recognizes, and which we think should be carefully considered. Sites chosen should, first and foremost, insure maximum safety during airport operations and, among other factors, should be selected on the basis of minimum dislocation of the economic and social activities in the area involved.

Availability of Aggregates

Establishment of airport sites is of concern to the economic welfare of the aggregates industries. Producers of aggregates stand to benefit as transport aviation develops because substantial quantities of aggregates are required in the building of airports but the location of airports makes a lot of difference in the source of aggregates. If they are built close in to cities where sources of aggregates available for metropolitan users are becoming scarce, there may well be presented a problem to consider. Certainly, an additional and continuing drain on limited sources of aggregates may have an adverse effect on the aggregates producer as well as his regular customers. It would mean earlier depletion of his resources and hasten the day when metropolitan purchasers must pay more for aggregates that will then have to be shipped in from more distant deposits.

Availability of acceptable aggregates for general construction is critical already in some of the metropolitan areas where airports are to be built, and favorably located deposits are being proved expendable even in the heavily populated areas where sources would appear to be adequate. Zoning ordinances and mounting pressures on the aggregates industries, to comply with oftentimes unrealistic regulations or get out, are a growing threat to aggregates producers, among other industries close in to developing areas.

It seems to us that the public interest must be considered in any decisions that will reduce the availability of economical sources of aggregates to a metropolitan area. Once they are exhausted they are gone forever and the only recourse would be higher construction costs from then on due to the necessity of paying high transportation charges for materials from distant sources.

Demands for Aggregates

Even without new airport construction, a number of areas are marked for major defense projects which will drain off much of the local materials and manpower. The buildup of defense construction expenditures recalls how, after the last war, many aggregates producers were left with greatly depleted and even nearly exhausted deposits of material. Certainly, they have not fared equally as to their competitive position in the future. It is true, on the other hand, that construction has fallen off sharply in some sections of the country, but a tremendous backlog of needed building exists.

Since metropolitan areas continue to widen greatly with growth of population, it appears that relatively distant airports served by modern, express highways into the city might ordinarily be the best solution to safety and the over-all problem. Then, the producer could supply at least a major part of the aggregates, if necessary, from sources beyond the airport and set up facilities to service the project on a continuing basis after construction is completed.

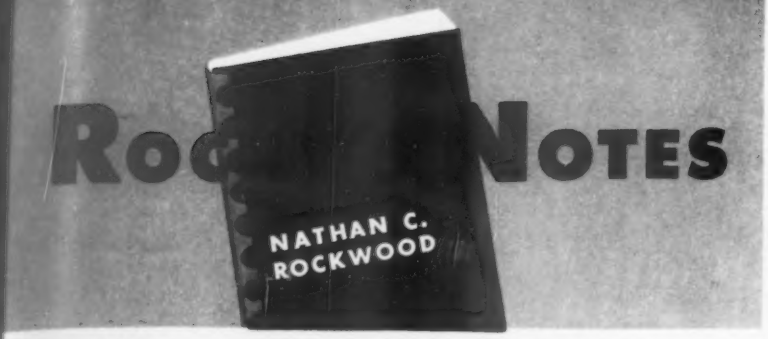
The President's Airport Commission has gone on record as recognizing that the inadequacy of roads is one of the greatest deterrents to the development of transport aviation, and has urged that airports be made a part of community master plans with emphasis on the need for limited access highways to reduce waste of time.

Producers of aggregates have a stake and might state their views before community planning commissions.

Bror Nordberg

DEPENDABLE as a source... DEPENDABLE as a service
KRAFT BAG MADE-TO-ORDER HEAVY-DUTY
MULTI-WALL SHIPPING SACKS
Custom-made to fit your specific needs, Kraft Bag Multi-Wall Shipping Sacks render full value in service—deliver full value to your customers... flexible in filling, rugged in handling, tough in transit, they empty c-l-e-a-n, with less dusting or sifting!
2 to 6 ply plain or printed 1 to 4 colors
There is no substitute for kraft!
3 GENERATIONS OF BAG SPECIALISTS
SELF-CONTAINED • SELF-SUSTAINING
producing our own pulp and paper and other components in our own integrated plants, at Gilman, Vt. and St. Marys, Ga.
Gilman PAPER CO.
KRAFT BAG CORPORATION
KRAFT BAG CORPORATION
GILMAN PAPER COMPANY SUBSIDIARY
630 Fifth Avenue, New York 20, N.Y.
Daily News Bldg., Chicago 6, Ill.
If your product fits into a bag — we'll make the bag to fit your product.

UNIVERSITY OF MICHIGAN LIBRARIES



The shadow of things to come

REGARDLESS OF THE OUTCOME of the November elections we shall have some changes in the executive and legislative departments of the federal government. However, such changes are probably to be more in personnel than in governmental philosophy. The most that can be expected is that our national urge to save the "free" nations of the world from Russian communism by means of brotherly love and largess will be carried on with greater intelligence, efficiency and economy, not to mention ordinary honesty. As such a comprehensive experiment in practicing Christianity has never been tried in this world since the birth of its Founder, who can say it is not the right thing to do?

However, our "crusade" might better be carried on with full knowledge of all that it means to us and our successor citizens of these United States of America. Let it be remembered that it is a violation of every biblical precept, and "an abomination in the sight of the Lord," for the dispensers of such virtues of faith, hope and charity, to attempt to profit or capitalize on them; for then they cease to be virtues. In that respect our government and many of our people are obviously in the dark, at least from an altruistic point of view. From many complaints to the effect that our charitable efforts are not being appreciated by the recipients, a neutral observer can hardly escape the conviction that the givers must have ulterior motives. We should say governmental representatives of the givers, for the givers are the people of the United States, and as a whole they appear confused or indifferent.

Our "Prosperity"

The present political motive, and possibly the ulterior motive in the eyes of most politicians, who put election returns above principles of Christianity and of political economy, is to create an impression of domestic prosperity. If it is prosperity to have every available person exploiting and sending abroad all possible removable products of our national assets in exchange for bundles of domestic paper money of constantly depreciating purchasing power, we are indeed prosperous. However, let's view this brand of prosperity with some comprehension of its ultimate end. For some day we must wake up to find many of our originally rich natural resources near exhaustion, and nothing to exchange for those we may then need from the rest of the world but our brains, skill and know-how. These remaining assets may suffice for a time, as they have in Great Britain, but while natural resources such as readily available coal, iron, petroleum, etc., may be considered the especial gifts of God to a fortunate nation, God has given no nation a monopoly of brains, skill and enterprise. It may be the divine mission of those who have such natural wealth to share it for free with those who have none, but our prior experience is with a world whose inhabitants have not yet taken divine missions very seriously. Maybe that is what is wrong with the world!

Obviously, the problem involved is a far more complex one than can be solved by mere considerations of immediate political expediency, which we fear is all that has been applied to its solution up to this time. It has moral implications both for our own people and those of the rest of the world, of which now and then we receive some slight inkling from confused political orators. Certainly a new and more intelligent and intellectually honest federal administration can do much to enlighten the people of this country and of the world in general. If we are doing what we are from a noble Christian motive, it certainly should not be confused with a sordid political motive to maintain our domestic "prosperity."

Bogus Prosperity

Summer tourists returning from Canada are reported to be surprised, indignant and chagrined to find that United States currency, hitherto in their own opinion the soundest in the world, is discounted some 5 percent by our northern neighbor. There is probably more than one reason for this, such as the recent heavy investment of American dollars in Canadian enterprises, the growing self-sufficiency of Canada in the matter of petroleum and many manufactured products, etc., but doubtless a very important factor is that the Canadian government has succeeded in establishing its currency on a sounder basis than has the United States. While we in this country continue to operate unconcernedly with huge national deficits, the Canadians have not only balanced their national budget, but are making progress in reducing their national debt. Perhaps this experience and the knowledge gained from it will help wake up Americans to the actual meaning of current "prosperity."

Import Problem

The American people do not appreciate that what they are doing actually does call for an understanding Christian attitude. This is illustrated in Congressional reaction, which of course is a reflection of the popular attitude, toward the President's recent rejection of the U.S. Tariff Commission's proposal to raise tariffs on Swiss watches and on figs and garlic from Mediterranean countries. It should be clear enough to anyone that if this country is actually engaged in a noble-hearted, honest attempt to help the rest of the "free" world get on its feet economically so that it will no longer require gifts of money and credit, we must be sympathetically prepared to accept the products those countries are able to export and which we can use. The manufacturers of watches and their employes, and the growers of figs and garlic, in this country are few and far between, hence they are politically impotent. But what will happen when European manufacturers invade our domestic markets with cement, iron and steel products, and a mass of manufactured goods, many of which they can make as good or better and much more cheaply than we can? Moreover, they can transport them in their own ships for far less than the cost of our internal rail transportation. Will the political powers that be have the moral strength or wisdom to stand by a principle in the face of political pressure by important, economically-interested groups of voters? Can we submerge our self interest in maintaining employment at home in the same self-sacrificing way we are now serving the rest of the world under the guise of domestic "prosperity"?

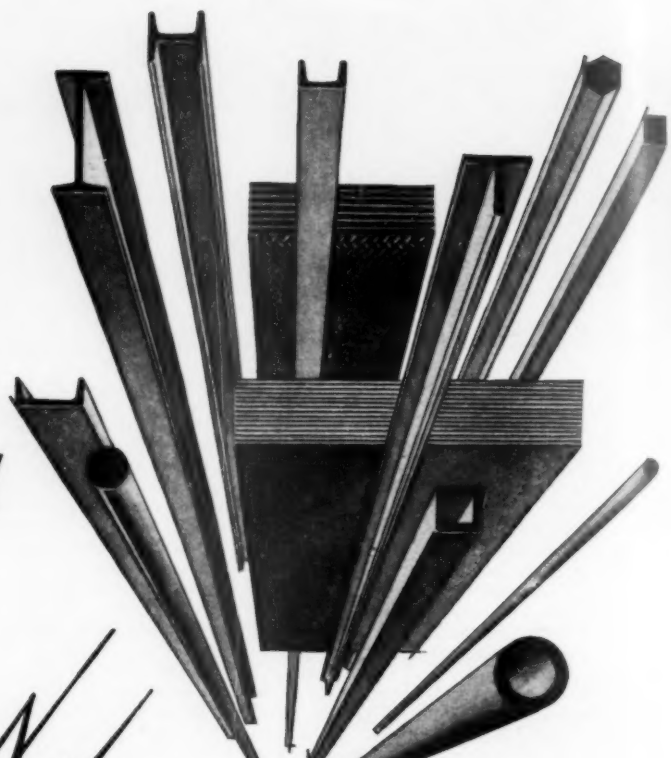
Our citizens most certainly should have a better understanding of the national program as a whole, if such a program exists. Had they that understanding now, they might not be so complacent about the never ending national deficits with the accompanying upward spiral of wages and prices, or the constant depreciation of their U.S. dollar. We have no rich uncle as Great Britain has to stem this trend toward national bankruptcy. We must learn eventually, as Britain already has, that in a competitive world economy the only recipe for maintaining national solvency and a "high standard of living" is the same as it has always been: by individual and national thrift and so far as possible by wasteless industry.

For 20 years the American people

(Continued on page 134)

UNIVERSITY OF MICHIGAN LIBRARIES

STEEL FOR EVERY QUARRY NEED



In stock...Prompt shipment

We carry a wide range of steel products in our 15 plants strategically located from coast to coast.

A good many kinds and sizes are in short supply at the present time, but we are still able to take care of most requirements.

So when you have any problem of steel procurement, application, or fabrication, we will be glad to work with you.

PRINCIPAL PRODUCTS

CARBON STEEL BARS—Hot rolled & cold finished
STRUCTURALS—Channels, angles, beams, etc.
PLATES—Many types including Inland 4-Way Safety Plate
SHEETS—Hot & cold rolled, many types & coatings
TUBING—Seamless & welded, mechanical & boiler tubes
ALLOYS—Hot rolled, cold finished, heat treated
STAINLESS—Allegheny bars, plates, sheets, tubes, etc.
REINFORCING—Bars & Accessories, spirals, wire mesh
BABBITT—Five types, also Ryertex plastic bearings
MACHINERY & TOOLS—For metal fabrication

CALL RYERSON

JOSEPH T. RYERSON & SON, INC. *Plants at:*

NEW YORK BOSTON PHILADELPHIA CINCINNATI CLEVELAND DETROIT PITTSBURGH
BUFFALO CHICAGO MILWAUKEE ST. LOUIS LOS ANGELES SAN FRANCISCO SPOKANE SEATTLE

L R T S

SOMETIMES one can learn more from an example of bad labor relations, and their outcome, than from the success of an employer in overcoming burdens thrust upon him by too zealous prolabor government bureaucrats. To illustrate our point we have two interesting and revealing decisions by the U.S. Circuit Court of Appeals, Sixth District, Cincinnati, Ohio, both referring to the same employer*, in different actions, both dated July 30, 1952. The first case was brought by the National Labor Relations Board for enforcement of a board order of October, 1949, to the employer to cease unfair labor practices, and was upheld by the court. The second case upheld the rights of the employer to recover damages in a secondary boycott, which was preventing a contractor from erection of a new building for the employer. The second action grew out of the bad labor relations established in the first instance; and these bad relations appear to have come about largely through bad tempers and a desire for revenge on both sides.

The employer in this instance was a clay products manufacturer and the labor union involved was United Brick and Clay Workers of America, affiliated with the American Federation of Labor. Until March, 1948, the employes were unorganized. Finding out that his employes were about to hold an election on the organization of the union, the employer "addressed the assembled employes, referred to the privileges enjoyed by them in the past, and warned them that if the election [for union organization] was won, they would lose their privileges and freedoms." After the election, in which the union did win a majority, the employer again addressed his employes in one of the departments (apparently informally) "stating that he was going to show them what he could do for having stabbed him in the back." Eventually, from then on he went about the plant proclaiming how he expected "to get even" with what he evidently took to be disloyalty to himself.

The employer's attitude was further illustrated when the bargaining committee of the union attempted to negotiate with him. He is quoted as saying that having chosen their side "if you are out of work and starving, it won't be my fault." Soon afterward the working hours were reduced from 48 hr. per week to 40, so that without the overtime, earnings of the employes were much reduced. Various small privileges, such as smoking on the job, leaving the plant as soon as the day's work was completed, etc., were revoked. To a local newspaper reporter the employer evidently in anger discussed his labor situation and hinted that it would not only cancel contemplated enlargement of his plant, but eventually it would result in moving the whole operation elsewhere. That is probably recitation enough to show how the employer reacted to his employes' perfectly legitimate right to organize, and perhaps also throws considerable light on why they desired to organize.

*Doma Artware, Inc., Paducah, Ky.

Many Meetings—No Contract

Under the circumstances it is not surprising that contract negotiations did not progress even after many meetings. The employer, the president of the company, himself apparently refused to take a direct part in these meetings. He delegated the contracting to relatively minor employes—a plant manager and a woman office manager. These two, presumably acting under instruction of the president, refused to bargain with a "general organizer" for the A.F. of L. "because he was not an officer or member" of the Clay Workers' union. The subsequent meetings were held without him, although as the court pointed out, under the Labor Management Relations Act, the employes have the right to select any one they chose to represent them.

There were eight meetings in the course of a month's time. While the union's proposals on some items were in general accord with the practice prior to the trouble, the employer's counter proposals on the other hand showed a desire to retaliate. For example, the employer proposed to reduce vacation privileges. His proposal for paying time-and-a-half instead of double-time for holidays worked, the union was willing to accept. The employer's proposal on wage scales was read from a manuscript, but the union negotiators were not permitted to have a copy. There was, naturally, a difference of opinion as to what it meant, the union contending that in reality it did not provide any wage increase; and moreover, it was in such detail and so difficult to analyze without study that it was impossible to accept it as read.

After more futile meetings it was agreed to call in the U.S. Conciliation Service. However, by this time the union negotiators decided "we have gone as far as we can get" and voted to call a strike, although no specific date was set, as it was also decided to first give the Conciliation Service a chance. This action in authorizing a strike did not comply with the national union's constitution for approving a strike by a local, and the employer attempted to use this fact but without success in his defense. The meeting with a conciliation commissioner was set for a certain date, then postponed by employer's attorney to a date that turned out to be not agreeable to the conciliator, so it was set ahead another two days. Through a mix-up the conciliator did not succeed in notifying the union representatives of this last minute change and, apparently, when only they showed up for the meeting they "blew their tops" and called a strike to begin the next day.

From this point on, attorneys for both the employer and the union took over, and, as usually happens in such instances, things went from bad to worse. The employer's attorney took the position that he was not authorized to meet any representative of the union, because the employer took the "legal position" that he now had no employes on strike to negotiate with—in other words they were all fired. Even when the union members voted to return to work pending further negotiations, the employer held to his position that they were no longer employes and hence could not be reinstated as such.

Rules Against Employer

The National Labor Relations Board, having been called in, ruled "that Respondent's conduct during the negotiations with the Union constituted a refusal to deal with the Union in good faith and violated Section 8 (a) (1) and (5) of the Act, Section 158 (a) (1) and (5) Title 29 U.S. Code; Respondent discharged and refused to reinstate 66 of its employes because they had engaged in a strike thereby violating Section 8 (a) (1) and (3) of the Act, Section 159 (a) (1) and (3), Title 29 U.S. Code; and that none of the 66 employes who were refused reinstatement, engaged in such conduct as to deprive them of reinstatement under the Act. The Board's order directed the Respondent to cease and desist from (a) discouraging membership in United Brick and Clay Workers of America, A.F.L., or in any other labor organization of its employes, by discharging or refusing to reinstate any of its employes; (b) refusing to bargain collectively with United Brick and Clay Workers of America, A.F.L., as the exclusive bargaining representative

(Continued on page 130)

UNIVERSITY OF MICHIGAN LIBRARIES

Carries the Load for WYANDOT DOLOMITE

Fairfield Conveyor Systems work around the clock for Wyandot Dolomite, Inc., Carey, Ohio, in handling and processing dolomite.

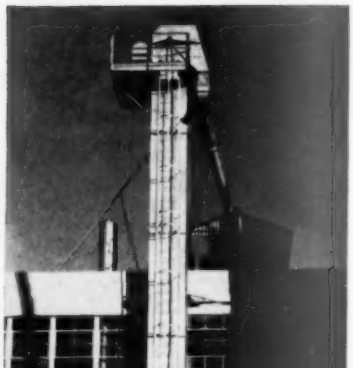
A typical example of the many rugged material handling jobs assigned to Fairfield, these systems utilize every component in the bulk material handling field to bring you economical operating costs by eliminating costly old-fashioned material handling methods. Then too, responsibility for the complete handling system rests with one source—for Fairfield designs, fabricates and installs the complete job.

Check with this outstanding organization on your bulk material handling needs today. Bulletin 152, describing Fairfield Systems, is available on request. Write the Contract Division, Fairfield Engineering Company, Marion, Ohio.

THE FAIRFIELD ENGINEERING COMPANY
349 Chicago Ave., Marion, Ohio

FAIRFIELD

Specialists in bulk material handling



Centrifugal discharge type elevator designed and built by Fairfield at a modern processing plant.

One of a great variety of Fairfield Belt Conveyors at work in an eastern chemical plant.

PEOPLE in the news

Concrete Consultant

CARL A. MENZEL, fomerly manager of the Housing and Cement Products Bureau, Portland Cement Association, Chicago, Ill., has been appointed consultant on concrete

Carl A. Menzel

technical problems. S. H. Westby, assistant manager of the bureau since 1945, succeeds Mr. Menzel as manager.

Mr. Menzel is well known to the engineering profession for his extensive research and development work on building materials and construction techniques. In 1951, he won the annual award of the Concrete Reinforcing Steel Institute for his contribution to the development of an improved type of deformed bar for use in reinforced concrete. He has also received the Dudley Medal of the American Society for Testing Materials and the Wason Medal of the American Concrete Institute. A graduate of the University of Illinois,

S. H. Westby

Mr. Menzel received a degree in mechanical engineering in 1917. He joined P.C.A. in 1928 as an associate research engineer. He has been manager of the Housing and Cement Products Bureau since 1947.

Mr. Westby, a civil engineering graduate of the University of Illinois, joined the association in 1943 and was appointed assistant manager of the Housing and Cement Products Bureau in 1945. Before joining P.C.A., he was associated with Consoer, Older & Quinlan, consulting municipal engineers in Chicago; H. M. Byllesby Engineering & Management Corp., Chicago; the Illinois State Highway Department; and Columbia Steel Co., Chicago.

Named General Manager

WILLIAM M. NORTH, secretary of National Gypsum Co., Buffalo, N.Y., has been promoted to general manager of the Kansas Ordnance Plant at Parsons, Kan. He succeeds Colon Brown, who will have general supervision of four subsidiaries including the two recently acquired Wesco Waterpaints, Inc., concerns in Montreal, Canada, and Berkeley, Calif. He will be located in Buffalo. Douglas A. Littlewood has been named to succeed Mr. North as secretary. Fred A. Wagner, formerly controller at the Kansas Ordnance Plant, has been appointed assistant treasurer and auditor in Buffalo, N.Y.

Heads Public Relations

RICHARD S. FUNK has been appointed head of the newly created public relations department of the Perlite Institute, New York, N.Y. Mr. Funk, former Ohio newspaper and advertising man, is a journalism graduate of Western Reserve University.

Vice-President Retires

A. C. CRONKRITE has retired as vice-president of central region sales, Chicago, Ill., Universal Atlas Cement Co., New York, N.Y. He will be succeeded by George S. Neel, western regional sales manager, who has been named vice-president of central and western regional sales. A native of Chicago, Mr. Cronkrite started his 52-year career with U.S. Steel subsidiaries as office boy with the American Steel and Wire Co. in Chicago, later becoming invoice clerk and cost accountant. In 1907 he transferred to Universal Atlas Cement Co., starting as a clerk and later becoming a salesman for the western territory.

A. C. Cronkrite

He served in this capacity until 1914, when he became special representative in Chicago. One year later, he was appointed division sales manager for metropolitan Chicago and, in 1928, was advanced to assistant general sales manager, Chicago. In 1937, he was elected vice-president of central region sales.

Mr. Neel is a native of Kamrar, Iowa, and is a graduate of the Law School of Drake University. He joined Universal Atlas in 1919 as a salesman covering the Des Moines territory, and served in various sales management capacities in St. Louis, Kansas City and Des Moines. In 1939, he was promoted to sales manager, metropolitan Chicago territory. He has been western regional sales manager, Chicago, since 1949.

George S. Neel

On N.A.M. Committee

STAN R. NAVAS, president of Concrete Pipe and Products Co., Inc., Richmond, Va., has been appointed to the taxation committee of the National Association of Manufacturers.

Committee Member

F. R. SMITH, president of Ready-Mix Concrete Co., Reno, Nev., has been named a member of the government economy committee of the National Association of Manufacturers.

On Board of Directors

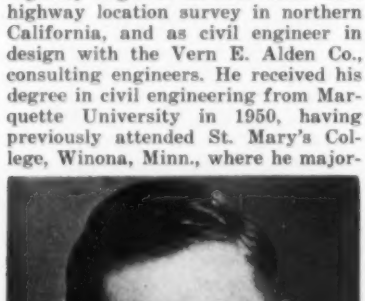
EDWARD P. LYMAN has been elected a member of the board of directors of Magnesia Talc Co., Inc., Burlington, Vt., to serve the unexpired term of his late father, Elias Lyman.

Division Engineer

GEORGE H. DENT has been named division engineer of The Asphalt Institute, New York, N.Y., with supervisory duties over Division I of the field engineering staff, which includes New England, the balance of the Atlantic Seaboard, and the states of Tennessee, Alabama, Mississippi and Louisiana. He will continue to make his headquarters in Washington, D.C.

N.C.M.A. Engineer

EDWARD R. MANGOTICH of Chicago, Ill., has joined the National Concrete Masonry Association as assistant engineer. Formerly with the Department of Commerce in the Bureau of Public Roads, San Francisco, Calif., Mr. Mangotich has also served as highway engineer in connection with highway location survey in northern California, and as civil engineer in design with the Vern E. Alden Co., consulting engineers. He received his degree in civil engineering from Marquette University in 1950, having previously attended St. Mary's College, Winona, Minn., where he majored in pre-engineering. He served as a Navy pilot during the war and at the present time holds a commission of lieutenant (J.G.) in the Naval Reserve.



Edward R. Mangotich

Frank G. Erskine

Managing Director

FRANK G. ERSKINE has been appointed managing director of the Expanded Shale Institute. He was formerly engineer of the Housing and Cement Products Bureau of the Portland Cement Association at Washington, D.C. Mr. Erskine, who is considered an authority on lightweight aggregates in both block manufacture and monolithic concrete, received his B.E. degree from the University of Mississippi and his degree in civil engineering from Cornell University.

Officers of the institute are: S. Carl Smithwick, Smithwick Concrete Products, Portland, Ore., president; W. W. Allen, Hydraulic Press-Brick Co., St. Louis, Mo., first vice-president; Alex R. McVoy, Texas Lightweight Aggregates, Dallas, Texas, second vice-president; J. Murray Black, John H. Black Co., Buffalo, N.Y., secretary; and A. R. Waters, The Carter-Waters Corp., Kansas City, Mo.

General Purchasing Agent

JOHN P. BURROWS has been named general purchasing agent of International Minerals and Chemical Corp., Chicago, Ill. He was formerly assistant general purchasing agent.

District Sales Manager

GALEN THOMAS has been appointed district sales manager of acoustical tile, gypsum division, Henry J. Kaiser Co., Oakland, Calif.

Named Treasurer

GEORGE W. HORN, former certified public accountant of Richmond, Va., has been named treasurer of Alberene Stone Corp. of Virginia, Schuyler, Va. He is also treasurer and a director of Nelson & Albemarle Railway Co.

Director of Purchasing

WILLIAM F. LANGEFELD, formerly sales manager, has been appointed director of purchasing for Material Service Corp., Chicago, Ill., and its subsidiaries.

Sales Manager

WILLIAM F. ATKINS has been appointed sales manager of Lehigh Materials Co., Lansford, Penn., He was formerly district sales manager for Maryland, Pennsylvania and western New York.

Appointed Sales Manager

JACK KELLEY, formerly industrial sales representative in the Philadelphia office of National Gypsum Co., Buffalo, N.Y., has been appointed sales manager of lime and limestone products in the industrial division.

With Concrete Division

J. PAUL MARTIN, formerly assistant materials engineer of the Delaware State Highway Department, Dover, Del., has been appointed to the bituminous concrete division of The General Crushed Stone Co., Easton, Penn.

General Chemist

CHARLES H. DICKENS has been appointed general chemist of Universal Atlas Cement Co., New York, N.Y.

Sales Manager

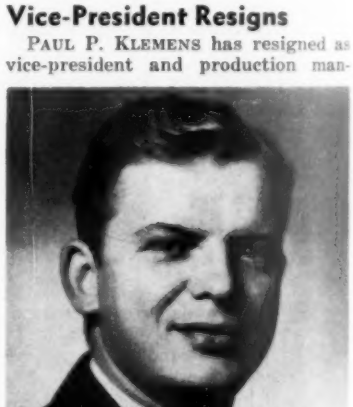
W. F. CAPPS has been appointed sales manager of West Lake Ready-Mix Concrete Co., St. Charles, Mo. He was formerly chief weight officer for the state highway department.

Sales Manager

A. W. SCOTT has been appointed sales manager of the metropolitan sales division of Lone Star Cement Corp., New York, N.Y.

Vice-President Resigns

PAUL P. KLEMENS has resigned as vice-president and production manager of Smithwick Concrete Products, Portland, Ore., to accept a position as assistant sales manager of Columbia Machine Works, Vancouver, Wash. In his new capacity Mr. Klemens will devote much of his time to promoting sales of the new three-block machine which the company has developed.



Paul P. Klemens

UNIVERSITY OF MICHIGAN LIBRARIES

Associate Director

DR. WILLIAM E. HAM, geologist and assistant director of the Oklahoma Geological Survey, has been promoted to associate director and named acting director of the Oklahoma Geological Survey. Dr. Ham was named acting director by the University of Oklahoma Board of Regents, which has control and super-

Dr. William E. Ham

vision of the survey, and succeeds Robert H. Dott, director for the past 17 years, who has resigned to accept the position of executive director of the American Association of Petroleum Geologists, with headquarters in Tulsa, Okla. Born in Guthrie, Dr. Ham attended the University of Oklahoma where he obtained his B.S. and M.S. degrees in geology, specializing in mineralogy and petrography. He joined the survey in 1941 as assistant geologist. Prior to that time he had served as an instructor at the University of Oklahoma School of Geology. Dr. Ham's work with the survey was primarily concerned with stratigraphy, structure and economic geology, which included detailed studies of glass sand resources in the central Arbuckle Mountain region and detailed investigations of dolomite resources in the Mill Creek-Ravia area.

On Board of Directors

LESTER CROWN, a director of Marblehead Lime Co., Chicago, Ill., has been elected a director of the Empire State Building Corp., New York, N.Y. Mr. Crown is the son of Colonel Henry Crown, chairman of the board of directors of Material Service Corp., Chicago, Ill.

Chief Engineer

RALPH R. BASLER has been appointed chief engineer of the South Dakota State Cement Commission, Rapid City, S.D., and Donald R. Marquardt has been named superintendent in charge of production.

Director of Promotion

LEO H. CORNING has been appointed director of promotion of the Portland Cement Association, Chicago, Ill., and Thor Germundsson has been named manager of the Structural and Railways Bureau. Mr. Corning is an authority on reinforced concrete construction and has been a member of the association for 23 years. He received his B.S. degree in civil engineering from Case Institute of Technology. He joined the staff of the Structural Bureau in 1929, was appointed assistant manager in 1935, and manager in 1949, which position he held until his recent appointment.

Mr. Germundsson, who succeeds Mr. Corning as manager of the Structural Bureau, joined P.C.A. in 1930. He was graduated from the University of Copenhagen and later received an M.S. degree in civil engineering from the University of Illinois as a Fellow of the American-Scandinavian Foundation. Mr. Germundsson is a nationally known authority on prestressed concrete and is the author of numerous books and papers on the design and analysis of reinforced concrete.

OBITUARIES

HARVEY WHIPPLE, editorial consultant and retired secretary-treasurer of the American Concrete Institute, Detroit, Mich., died September 6.

Harvey Whipple

Prior to joining A.C.I. as part-time secretary in 1919, Mr. Whipple had served with the *Detroit Free Press* and *Detroit News* and as managing editor of *Concrete Cement Age*. In order to devote full time to institute affairs he assumed the additional duties of treasurer in 1921. Mr. Whipple inaugurated the *ACI News Letter* in 1920, which became part of the *Journal of the American Concrete Institute* in 1929.

STANLEY G. STEWART, vice-president and director of Consolidated Cement Corp., Kansas City, Mo., died recent-

Stanley G. Stewart

ly after a long illness. He was 70 years of age. Born in Nevada, Ohio, Mr. Stewart moved to Kansas City with his parents in 1887. He started his business career with the Kansas City Belt Railroad Co., later the Kansas City Terminal Railroad. He later became assistant treasurer of Arkansas Bridge Co. and president of Kansas Cement and Material Co. In 1936 he was appointed vice-president and director of Consolidated Cement Corp. Mr. Stewart had been identified with the portland cement industry for over 40 years.

THOMAS J. BEST, a pioneer in the gypsum industry, died recently after a long illness. He was 89 years old. A native of England, Mr. Best founded the first gypsum mill in Medicine Lodge, Kan., in 1889, and operated it under the name of Best Bros. Keene's Cement Co. until selling out in 1927. The National Gypsum Co. bought the plant in the 1930's. Mr. Best became interested in gypsum at an early age. He spent his early life in Kirkby-Thore, Westmoreland, England, where there were extensive gypsum deposits and his father owned several gypsum quarries. He moved to Medicine Lodge in 1889, when he built the first gypsum mill, and lived there until the time of his death. Mr. Best's mill was the first gypsum plant west of the Mississippi river.

EDWIN H. FOX, general manager of Cincinnati Concrete Pipe Co., Cincinnati, Ohio, died recently. He was 60 years of age. Mr. Fox was past president of the American Concrete Pipe Association and a member of the National Society of Professional Engineers.

ARCH FRANKLIN POPE, retired quarry operation executive at Millville, W. Va., died recently at the age of 70.

UNIVERSITY OF MICHIGAN LIBRARIES

Acceptance

Wherever you are, there's a MARION working near you —a MARION dragline, clamshell, crane, pull shovel, pile driver or walking dragline. The *worldwide acceptance* MARION machines have won over a period of 68 years is one of the best recommendations we have.

Their selection for such impressive assignments as the Boulder Dam, Panama Canal, TVA dams, and other big projects in construction, mining, quarrying and coal stripping endorses MARION as a name you can trust.

MARION has many "firsts" in the development and refinement of excavators and material handling machines. MARION offers more types and sizes of machines than any other manufacturer.

Look to MARION for resourceful, conscientious help in solving your excavating and material handling problems.

Write today for a copy of Bulletin 403-A—*it pictures and describes in condensed specifications every machine in the world's most complete line of excavating and material handling machines.*

industry news

Percentage Depletion Amendment Clarified

THE RECENT ENACTMENT of an amendment into the Internal Revenue Code, affording the same percentage depletion relief to fiscal year companies as permitted those operating on a calendar basis, has presented the question as to whether amended returns would be accepted by collectors of internal revenue from affected companies which have not paid in full their tax covering the year 1951.

The National Crushed Stone Association, in order to clarify the matter for its members, made an investigation and now reports that under the "Bureau of Internal Revenue Instructions to Individiual Collectors of Internal Revenue," this question is held to be within the discretion of the collector and, unless the amended return is clearly frivolous or erroneous, he should accept an amended return to make adjustments of the remaining payments due. In view of this ruling, N.C.S.A. suggests that it would probably be advisable for affected fiscal year companies to file amended 1951 tax returns rather than file claims for the refund.

Celebrate Safety Records

EMPLOYES OF TWO DISTRIBUTING plants of Huron Portland Cement Co. were recently honored at banquets, in commemoration of their long records of accident-free operation.

Employes of the Milwaukee, Wis., plant were honored for their record of more than 14 consecutive years without a lost-time accident through the years 1934-1949.

Employes of the Green Bay, Wis., plant were similarly honored for its record of over 13½ accident-free years. Since the plant began operation in 1938, approximately 5000 days ago, not one employe has lost time because of accident. Each employe was presented with an initialed wallet to commemorate the record.

Limestone Plant

THE KELLEY ISLAND LIME & TRANSPORT CO., Cleveland, Ohio, is completing negotiations with a group of six steel companies which would result in construction of an $8,000,000 to $9,000,000 limestone plant at Rockport, Mich. Under the program the steel companies will form a separate company to build the processing plant on Kelley Island's quarry properties there. The facilities will include a pier to accommodate the large carriers used in transporting the fluxstone to the mills.

Kelley Island, it is understood, will operate the plant under a fee basis. The company also will receive royalties for its high-grade metallurgical limestone found on the properties. It is estimated 4,000,000 tons of limestone annually will be produced at that location, enough to provide the steel firms with an ample supply of the material. The company discontinued operations in Michigan in 1947 and the plant was dismantled in 1949. Since that time the quarries have remained closed.

Industrial Sand Shipments

THE NATIONAL INDUSTRIAL SAND ASSOCIATION estimates that its car supply requirements for the third quarter of 1952 will be approximately 7 percent lower than for the corresponding quarter of 1951.

Railroad car shipments for industrial sand during the second quarter of 1952 totaled 50,737 cars, a decrease of 6786 cars, or approximately 12 percent, from the total car shipments in the second quarter of 1951.

The tonnage shipped by truck during the second quarter of 1952 totaled 291,604 tons, compared with 297,237 tons for the same quarter of 1951. Truck shipments were reported by 36 member companies in the 1952 period, while 40 members reported truck shipments in the 1951 period.

Canadian Asbestos Exports

CANADIAN EXPORTS OF ASBESTOS in 1951 amounted to 660 short tons of crude asbestos, 324,594 short tons of milled fibers and 617,060 short tons of asbestos-waste-refuse shorts, as recently reported by the Bureau of Mines in *Mineral Trade Notes*.

Of the crude asbestos exports, 464 tons were shipped to the United States; 100 tons to the United Kingdom; 65 tons to France; 18 tons to Japan; 10 tons to Germany; and 3 tons to Belgium.

Of the milled asbestos fibers, 199,168 short tons were exported to the United States; 30,707 tons to the United Kingdom; 16,373 tons to France; 13,466 tons to Belgium; 10,435 tons to Australia; and 54,445 tons to 35 other countries.

Exports of the asbestos-waste-refuse shorts were shipped as follows: 512,433 tons to the United States; 38,023 tons to the United Kingdom; 17,620 tons to France; 11,986 tons to Belgium; and 36,998 tons to 34 other countries.

Florida Phosphate

VIRGINIA-CAROLINA CHEMICAL CO. is planning to build a plant at Nichols, Fla., that will recover uranium as a by-product of phosphate operations. This will be the third new plant to be built in the Hillsborough-Polk phosphate field to produce uranium as an added product. Both International Minerals & Chemical Corp. and Davison Chemical Corp., have started construction on plants.

E. C. Heinrichs, vice-president of Virginia-Carolina, said the Nichols plant will include three complete units, a sulfuric acid plant, a phosphoric acid plant and a complete multiple superphosphate plant, and that it will have provisions for the extraction of uranium. Research is now underway for production of fluorine and alumina as well as uranium from Florida phosphate.

Awarded Large Contracts

J. L. SHIELY CO., Minneapolis, Minn., was recently awarded four separate contracts, totaling $1,088,990, for supplying concrete aggregate for the Garrison, N.D., district of the U.S. Army Corps of Engineers.

Cover Picture

AN OUTSTANDING FEATURE of Canada's newest sand and gravel plant, operated by Consolidated Sand and Gravel Ltd. near Paris, Ont., is the method adopted for stockpiling coupled with the method of recovery from stockpiles and loading. Recovery and loading are separate from and independent of the production process, so that either may be carried on alone. The plant was designed primarily for railroad car loading, although provision has been made for truck loading as well.

This month's cover shows the large stacker tower, the top level which is about 70 ft. above the recovery tunnels. Washed stone is separated here into four sizes; each size is delivered via chutes and transition boxes to a stacker conveyor. Each stockpile holds about 7000 tons, 3500 tons of which can be reclaimed, without rehandling, through the recovery tunnels. The new plant is described in detail on page 93.

National Safety Congress

THE 40TH National Safety Congress and Exposition will be held in Chicago, Ill., October 20-24. A symposium on plant safety problems, highlighting the cement and quarry sessions, is scheduled for Tuesday afternoon, October 21. It will be moderated by M. C. M. Pollard, safety director, National Gypsum Co., Buffalo, N.Y.

J. E. Collins, supervisor of training for Universal Atlas Cement Co., will start the program with a talk on "Job Training for Safety." John Murdock, master mechanic for the Cedar Hollow, Penn., plant of Warner Co., will speak on electrical hazards found in small plants. The program will close with a talk by C. A. Gustafson, superintendent for The Callanan Road Improvement Co., S. Bethlehem, N.Y., on plant maintenance and its tie-in with safety.

Association Prepares Encyclopedia Article on Lime

NATIONAL LIME ASSOCIATION has announced availability of reprints of an encyclopedia article on lime and limestone, co-authored by Robert S. Boynton, general manager of the association, and Kent Jander, N.L.A. chemical engineer. The 36-page reprint from "Encyclopedia of Chemical Technology" (published by The Interscience Encyclopedia, Inc., New York, N.Y., 1952) covers history, properties, occurrence, production, economics and marketing of lime and limestone. It is in effect a "boiled-down" textbook on the subject, well-illustrated and clearly presented.

Since the encyclopedia covers primarily the chemical process industries, emphasis in the lime and limestone section is upon types of materials and their uses in the process industries. All other uses, such as building and agriculture, are described in some detail, however.

The association, recognizing the value the article can have for member companies, for use by technical staffs, salesmen, customers and other educational purposes, has ordered a large number of extra copies. These may be purchased through National Lime Association, 925 Fifteenth St., N.W., Washington 5, D.C., for 25 cents each, plus postage.

Industrial Explosives

CONSUMPTION OF INDUSTRIAL explosives in the United States in 1951 totaled 753,820,583 lb., which was 5 percent greater than in 1950 and was the second highest annual total on record, as reported by the Bureau of Mines.

A total of 152,353,497 lb. of explosives were used in quarries and nonmetal mines, an increase of 8 percent over the amount consumed in 1950. The states of West Virginia, Indiana, New Mexico, Michigan, Ohio and North Carolina all showed increased use of explosives over 1950. Among the states reporting decreases were Oklahoma, Iowa and Tennessee.

Quarries and nonmetal mines consumed 20 percent of all explosives used in the United States during 1951. Most of the explosives were of the high explosives other than permissible type, although some black blasting powder and permissibles were also used.

Zircon Sand

FOOTE MINERAL CO., Philadelphia, Penn., recently began production of foundry-grade zircon sand. Its use is claimed to give improved surface smoothness and greater accuracy in casting. Cleaning costs on castings made with zircon sand are substantially reduced, due to the sand's grain size, chemical inertness and high rate of heat diffusion, according to the company.

Oklahoma Cement Plant?

ESTABLISHMENT OF A NEW cement plant at McCurtain, Okla., is under consideration and the federal government has issued the proposed plant a 60 percent accelerated amortization tax plan over a five-year period. If the local tax situation and the problem of freight rates will permit, the plant will be built.

Plant Sets Safety Record

THE FULTONHAM, OHIO, PLANT of the Columbia Cement Division of Pittsburgh Plate Glass Co., recently completed its 1000th day of safe plant operation, working 2,017,885 man-hours without a lost-time injury. The plant has won the company's annual safety award six times in the past 12 years. It was also awarded the Portland Cement Association annual safety trophy in 1931, 1935, 1948, 1950 and 1951. The completion of the 1000 days of safe operation makes the plant eligible for membership in the Portland Cement Association's 1000-Day Safety Club.

Portland Cement Production

THE PORTLAND CEMENT INDUSTRY produced 21,342,000 bbl. of finished cement in July, 1952, as reported to the Bureau of Mines. This was a decrease of 5 percent compared with the output in July, 1951. Mill shipments totaled 25,084,000 bbl., an increase of 3 percent over the July, 1951, figure, while stocks were 2 percent above the total for the same month in 1951. Clinker production during July, 1952, amounted to 20,542,000 bbl., a decrease of 4 percent compared with the corresponding month of the previous year. The output of finished cement during July, 1952, came from 155 plants located in 37 states and in Puerto Rico. During the same month of 1951, 22,439,000 bbl. were produced in 152 plants.

Coming Conventions

October 20-24, 1952—
National Safety Congress and Exposition, Conrad Hilton, Congress, Morrison and Sheraton hotels, Chicago, Ill.

November 20-22, 1952—
American Concrete Pipe Association, 2nd Annual Short Course, Sherman Hotel, Chicago, Ill.

November 22-26, 1952—
National Concrete Masonry Association, Southeastern Regional Meeting, Sherry-Frontenac Hotel, Miami Beach, Fla.

January 14-15, 1953—
Wisconsin Concrete Products Association, 33rd Annual Convention, Plankinton House, Milwaukee, Wis.

January 18-21, 1953—
National Agricultural Limestone Institute, 2nd Annual Convention, Hotel Statler, Washington, D.C.

January 26-29, 1953—
National Concrete Masonry Association, 33rd Annual Meeting and Concrete Industries Exposition, Cleveland Public Auditorium, Cleveland, Ohio

February 2-3, 1953—
National Concrete Products Association (Canada), 4th Annual Convention, King Edward Hotel, Toronto, Ont., Canada

February 2-6, 1953—
National Crushed Stone Association, 36th Annual Convention, Hotel New Yorker, N.Y., N.Y.

February 23-26, 1953—
National Sand and Gravel Association, 37th Annual Convention, Fairmont Hotel, San Francisco, Calif.

National Ready Mixed Concrete Association, 23rd Annual Convention, Fairmont Hotel, San Francisco, Calif.

UNIVERSITY OF MICHIGAN LIBRARIES

California associations' banquet for V. P. Ahearn was well attended

California Associations Honor V. P. Ahearn

THE MUSIC ROOM of the Biltmore hotel, Los Angeles, Calif., on the evening of August 18th was the scene of an industry dinner given by the members of the Southern California Ready Mixed Concrete Association and the Southern California Rock Products Association on the occasion of the visit to Los Angeles of Vincent P. Ahearn, the executive secretary of the National Sand and Gravel Association and the National Ready Mixed Concrete Association.

Harold E. Bender, president of the Southern California Rock Products Association, was the master of ceremonies and introduced the 172 members of the industry who attended the dinner, at which Mr. Ahearn spoke. The group included members of the two industries from Utah, New Mexico, Nevada and Arizona as well as representatives from Ventura, Kern, Riverside and San Bernardino counties in California.

Mr. Ahearn delivered a most interesting and informative address, touching on the problems of the two industries which included the dangerous legislation now pending on the matter of federal control of proprietary trucking and also on the matter of area collective bargaining; the latter may be placed in jeopardy by bills now pending, which are attempting to bar industry-wide bargaining on the national level. He also spoke on the matter of better employer-employe relations and of the necessity of the employer's regaining the friendship and confidence of his employes.

Members of the three standing committees of the southern California associations were introduced. These are the technical, transportation and labor relations committees.

Mr. Bender also introduced the specialists who look after the various problems of the southern California associations in the matters of unemployment insurance benefit claims, wage and hour, wage stabilization and salary stabilization, and the insurance consultant who efficiently handled the recent installation of the employe health and welfare plan for all employes. This became effective August 1, 1952. The southern California associations pride themselves on providing broad service to their members on many subjects where specialists are needed. The attorneys for the associations were also introduced, as well as the representative who follows the constantly recurring efforts to increase truck taxation.

New York Stone Producers Hold Annual Outing

NEW YORK STATE Crushed Stone Association held its annual summer outing at the Schuyler Meadows Club, at Loudonville, a suburb of Albany, N.Y., on September 4, 1952. On Wednesday afternoon, the day prior to the outing, a plaque was unveiled in memory of the late Harry R. Hays, who served for many years as secretary of the association. The plaque was donated by the bituminous group in the area. That evening the membership had its get-together dinner and cocktail party at the DeWitt Clinton Hotel in Albany.

The outing paralleled those held each year by the group, golf being the main attraction. As the weather was ideal, the golfers made the most of it. Luncheon was served out of doors. About 200 were registered, with about half that number being producers and the remainder New York State Highway officials who were guests of the association.

The golf tournament was won by the New York State Highway team captained by C. F. Blanchard, who on behalf of his team received the Harry R. Hays Memorial Cup as the trophy. Presentation of this new trophy was by Clarence A. Munz, president of the New York State Crushed Stone Association. Mr. Munz is vice-president of Eastern Rock Products Co., Utica, N.Y.

C. V. Tobin is secretary of the association; his assistant is Francis Mole.

New Loan Negotiated by National Gypsum

NATIONAL GYPSUM Co., Buffalo, N.Y., has secured a $25,000,000 loan from three insurance companies for expansion purposes and for retiring a long-term loan. The loan is for 25 years, at 3¾ percent interest. Payments on the principal will begin in 1957, at a rate of $1,250,000 annually.

About $18,500,000 of the loan will be used to pay off the present debt on which payments of about $2,000,000 per year are required, according to Melvin H. Baker, chairman of the board. The balance of the loan will be used for capital expansion. Current plans call for technological improvements in the company's plants, for new products, an executive office addition, and a new research center to be built in or near Buffalo.

Porous Aggregate Patent

VILAS E. WATTS, Palo Alto, Calif., assignor to Zonolite Co., Chicago, Ill., has been issued a Canadian patent (No. 485,346) on "Method of Producing Porous Aggregate Mixes," as recently reported in *The Canadian Patent Office Record*. The application date was listed as March 30, 1950, under Serial No. 598,144. Issuance of the patent was listed as July 29, 1952.

The patent concerns a method for mixing thermoplastic binding materials with lightweight, porous, inorganic aggregate to bind together the discrete particles of the aggregate, while effectively maintaining the open pores to impart insulating properties to the finished product.

Phosphate Fertilizer Plant

GARFIELD CHEMICAL & MANUFACTURING Co. and Stauffer Chemical Co. are forming a jointly owned corporation to build and operate a phosphate fertilizer plant west of Salt Lake City. The new undertaking will require between $4,000,000 and $5,000,000 for plant, equipment and working capital. Slated for completion late in 1953, the plant will produce more than 60,000 tons of contracted phosphate fertilizers a year. Phosphate rock from Wyoming and Idaho will be used.

Pavement Yardage

AWARDS OF CONCRETE PAVEMENT for the month of August and for the first eight months of 1952 are listed by the Portland Cement Association as follows:

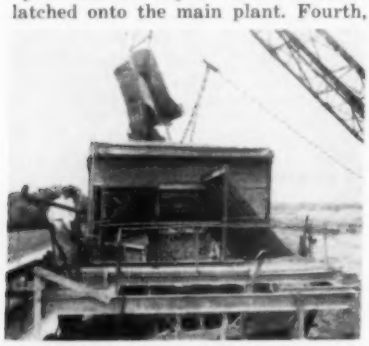
	Sq. yd. awarded during August 1952	Sq. yd. awarded during first eight months 1952
Roads	2,652,296	20,513,933
Streets and alleys	2,358,859	18,314,108
Airports	1,070,215	5,597,493
Totals	6,081,370	44,425,534

HH

Cars, as loaded, are pulled under loading pockets by a remote-controlled car puller (visible at extreme left)

A Plant Built on Ideas

THE LABAN SPUR plant of Texas Construction Material Co., near Columbus, Texas, has been in operation for many years. It is about to be moved to a new location. This 75 t.p.h. plant has many practical ideas incorporated. First, the 4-cu. yd. Bucyrus-Erie dragline was steam-driven and the operators changed it to an electric drive. It has a 110-ft. boom, for it strips, casts back stripped material into the worked-out pit, excavates gravel, and occasionally reaches far back and picks up the crushed gravel and puts it into the hopper. Second, the plant is portable, running on 90-lb. industrial rails. The plant is 34 ft. high and weighs 75 tons, so it is possibly one of the largest units of portable plants in existence. Third, the main plant pulls a trailer which is a portable bin, fed by a belt conveyor. The trailer is latched onto the main plant. Fourth, the oversize is crushed in a 10- x 36-in. Pioneer jaw crusher and the throughs are spouted back to the pit and reclaimed as needed by the dragline. About 20 percent of the gravel is crushed. Fifth, there are no bins, and as the cars are loaded they are pulled under the loading pockets by a remote-controlled electric car puller. This is also portable and is tied to the rails by two rail hooks or "dogs," as seen in the illustration. Two loading tracks are used, one on one side, and the other under the bins. A shuttle conveyor delivers to the outboard track. Sixth, the triple-deck, wet, 5- x 14-ft. Simplicity vibrating screen has been equipped with a forced-feed oil lubrication system which requires little attention. Seventh, an arrangement is planned for the cast-back stripped material. A tractor and bulldozer may be employed to level off the peak of the windrows formed by the dragline. As the stripped material is quickly reseeded, the land makes excellent pasturage and will produce more grass, acre for acre, than level land as there is more surface area on which to grow.



Portable plant rides over 90-lb. rails and is equipped with a jaw crusher for crushing oversize and a triple-deck vibrating screen; it is fed by an electrically-driven, 4-cu. yd. dragline having a 110-ft. boom

Arrow points to "dogs" which hold portable car puller to rails

Plant Communications

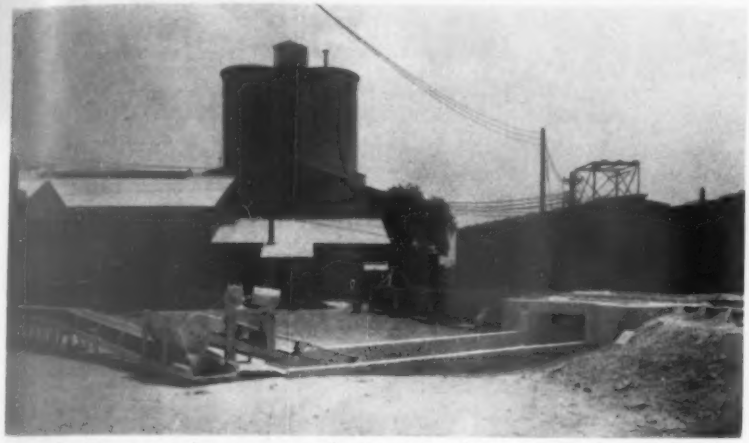
AT A FLORIDA PHOSPHATE mining operation, electrical and mechanical delays occur on an average of 624 times per year, at one of the mines alone. Importance of immediate maintenance service can be measured by the fact that it costs approximately $1,000,000 to build a dragline and about $7,500,000 to build a concentrating plant. Since the operation of the concentrating plant is wholly dependent upon continuous dragline operation, even a short-lived stoppage of production is expensive. To minimize costly down time as much as possible, the company has installed a Motorola 2-way F.M. radio system in each of its plants. Radio equipment is mounted on the draglines, or it can be mounted on other mining equipment, or in cars or trucks. Portable radiophones are also used. If a breakdown occurs, a maintenance crew can quickly be summoned and equipment soon restored for normal operation.

Safety Hatch

A MIDWESTERN LIMESTONE company operates eight diesel hydraulic locomotives for hauling approximately 5500-6000 tons of limestone per day from the quarry to the processing plant, a distance of about two miles. For a considerable part of this distance, the track bed lies near the quarry working face and a derailment could send the locomotive toppling into the pit below. To provide maximum safety for the operator an escape hatch was built into each of the locomotives. Simply by unlatching a lever at the right of his seat, the operator opens the entire panel beneath the side window to provide a full-height doorway for escape. In moving trains back and forth, the escape hatch always faces the land side of right-of-way.

A lever at right of seat opens panel on window side to provide full-height doorway for emergency escape

UNIVERSITY OF MICHIGAN LIBRARIES



Apron feeder on track hopper, under unloading point, discharges material to inclined belt

Unloading System

LARGE USERS OF AGGREGATES, industrial or foundry sand might be interested in the simple and inexpensive bottom-dump, car unloading system shown here. Too many of the concrete pipe and concrete block plants, during this mechanized age, still use wheelbarrows to unload cars.

In the unloading system shown here, the trackage at right (this side of box car) is elevated off the ground about two feet. A track hopper provided with a small apron feeder is under the unloading point. The inclined belt from the hopper receives its feed from the apron feeder.

Versatile Lift Truck

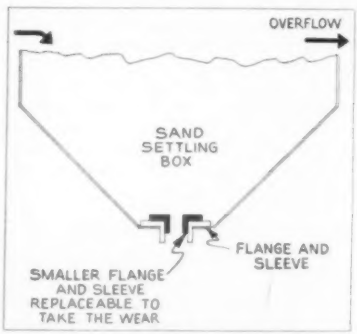
FORK-LIFT TRUCKS can find many uses around a plant which justify their use even though they are not prime pieces of equipment. In the accompanying illustration, the Clark unit is lifting the supporting steel framework off the chassis of a Ford truck so that a dump body can be

Fork lift unit lifts framework from truck chassis; a dump body may then be installed for haulage purposes

put onto the haulage unit. Thus one truck does two widely different types of jobs, for the steel framework shown is for loading and unloading septic tanks. In many cases trucks carry special equipment which, although used only a few minutes each day, is of such design that the truck cannot easily be used for any second purpose unless necessary changes can be readily made.

Sand Settling Boxes

USE OF SIMPLE SETTLING BOXES is still popular in some sections of the country. The one shown here is mounted directly under a vibrating screen.



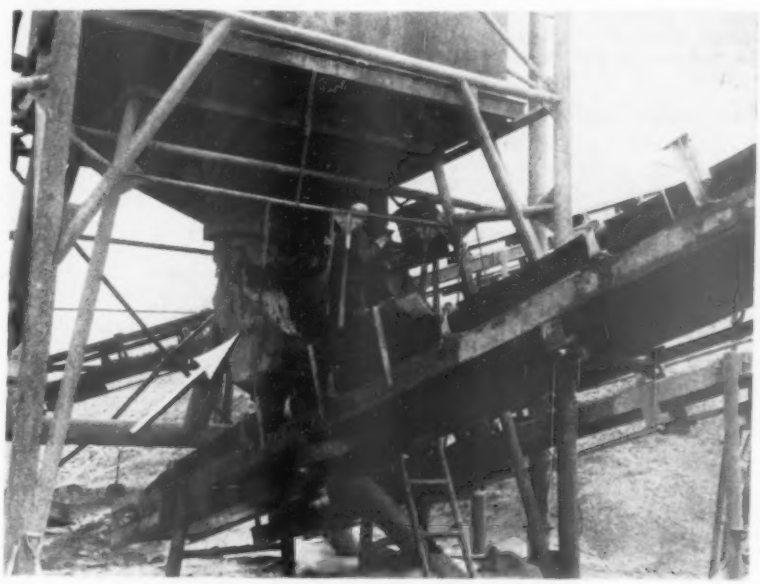
Outlet design of sand settling box

It is discharged manually by one of two gates that are intermittantly opened and closed by the operator. Below each gate is a stationary screen and excess water is carried to waste. In this installation, two stacker belt conveyors stockpile the sands over a reclaiming tunnel.

Another type of outlet was observed in a southern plant as shown in the drawing. This operator used

Sand box is mounted directly under vibrating screen

a series of flanged nipples, one fitting inside the other, reducing the size of the outlet to the desired point. The flanges were not bolted in place but were simply held there by gravity, plus the weight of the pulp over them. As the inner nipple became worn, it could be replaced easily. In this installation the sand was further dewatered by a drag.

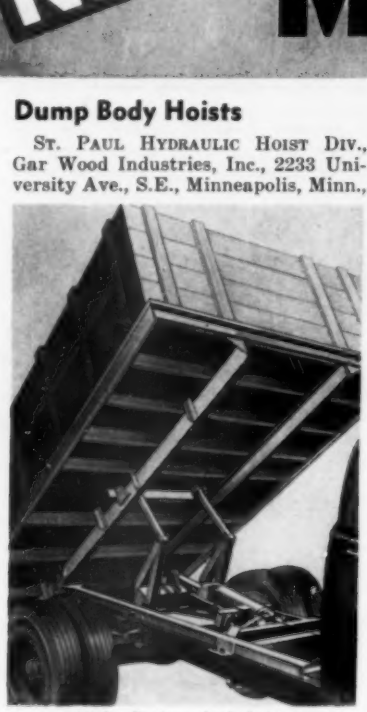


Arrow points to stationary dewatering screen

NEW Machinery

Dump Body Hoists

ST. PAUL HYDRAULIC HOIST DIV., Gar Wood Industries, Inc., 2233 University Ave., S.E., Minneapolis, Minn.,



Hydraulic dump body hoist

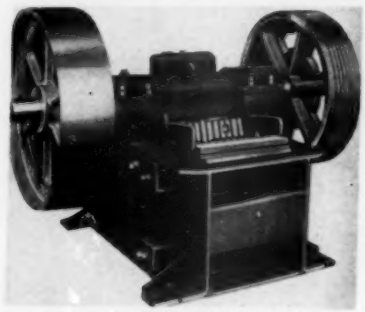
has introduced a new line of hydraulic dump body hoists designed especially for use with trucks of 128 in. and longer wheelbase under platform or flatbed bodies of 8 to 20 ft. long. Six models are available to fit applications from 7 to 15 ton capacity. The hoists feature a "stress eliminating" unit consisting of two tension links, one on either side of the cylinder, to absorb almost all dumping shocks, eliminate concentrated stresses and permit the use of a flexible subframe.

Magnetic Tagline

OSGOOD CO., P.O. Box 515, Marion, Ohio, has developed a magnetic tagline for use on clamshell or electromagnet services. It consists of a drum, mounted on the extension of the hoist-

Magnetic tagline for use on clamshells

ing drum shaft, which is provided with a series of "permanent" magnets. By their magnetic attraction to the flange of the tagline drum, a constant pull is exerted on the tagline rope. Different "pulls" can be obtained by varying the number of magnets.



Plain bearing lightweight jaw crusher

Lightweight Jaw Crusher

PIONEER ENGINEERING WORKS, INC., 1499 Central Ave., Minneapolis 13, Minn., has designed a 10- x 16-in. plain bearing jaw crusher that features a single wall pressed steel base. The pitman bearing is a full round bronze sleeve bearing. Side bearings are bronze on the bottom half and babbitt on the top half. Felt oil seals protect each end of each bearing. Reversible jaw plates are of manganese steel. Production capacity will range from 4 to 40 t.p.h., depending on the stage of reduction required.

Detachable V-Link Belt

BRAMMER CO., 684 Broadway, New York, N.Y., has introduced a detachable V-link belt that is prestretched, will not slip and can run in either

Detachable V-link belt

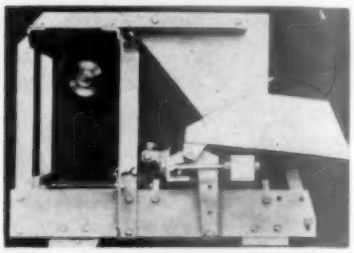
direction. Links contain more plys than in standard belts and are made of cloth impregnated with heat and oil resistant crude rubber.

Anti-Rust Paint

PAINT CORP. OF AMERICA, Fidelity Bldg., Cleveland 14, Ohio, has announced the addition of an aluminum anti-rust paint to its paint line. Known as PCA-102 Aluminum, the new paint is made of doubly pigmented aluminum mixed with a clear base vehicle, or rust inhibitive. The manufacturer states that the paint can be applied by brush or spray over rust without priming, scraping, wire brushing or sandblasting.

Vibrating Feeder

HENRY SIMON LTD., Stockport, England, is now offering a vibrating feeder called the "Velofeeder." The feed tray of the feeder (which can be 12 in., 18 in. or 24 in. wide) works like a conveyor, having a working stroke variable from virtually motionless to a maximum of nearly ¼ in.



Vibrating feeder with conveyor-like feed tray

at 1850 vibrations per minute. The motion of the tray is produced by a ⅛-hp. motor driving a small rotating out-of-balance weight assembly that gives impulses to the "anvil" on which it is mounted, the anvil being so arranged that it can oscillate between springs. On its rearward movement the anvil collides, via a rubber pad, with the feed tray—which also oscillates between springs. The springs and mountings are so designed that the two masses, anvil and feed tray, oscillate in opposite directions and collide once in every cycle; the force of collision determines the movement of the feed tray. Variation in the force of collision is obtained by altering the mean distance between the two masses. An electronic Servo controller can be incorporated on the machine to give automatic adjustment of feed rates.

Idler and Rail Rebuilding

MIR-O-COL ALLOY CO., INC., 340 N. Avenue 21, Los Angeles 31, Calif., has placed on the market the "Mir-O-Col 45-90" method for rebuilding tractor and shovel rollers, idlers and rails. The method combines the company's No. 45 and No. 90 wire into one process. The No. 45 wire has a high nickel content to withstand heavy impact and can be used in multiple-pass operations with no spalling. Hardness of deposit is from 22 to 28 Rockwell C. The No. 90 wire contains chromium, molybdenum and vanadium, and has a Rockwell C scale hardness of 46 to 48. Both wires are claimed to be readily adaptable to the submerged arc process of welding. The company has also developed new automatic welding heads and positioners for the method.

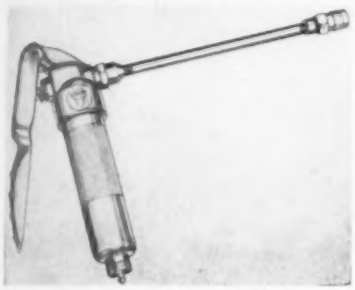
UNIVERSITY OF MICHIGAN LIBRARIES

Welding Electrode

WALL COLMONOY CORP., 19345 John R. St., Detroit 3, Mich., has announced a hard facing welding electrode, Wall-ex No. 2, giving a deposit material consisting of chrome, manganese, silicon and iron alloy. This abrasive and shock resistant deposit has stainless qualities approximately equivalent to type 410 stainless steel, with a hardness ranging from 49 to 53 Rockwell C. It is available in 14-in. lengths in 1/8-, 7/32- and 1/4-in. diameters.

Lubrication Gun

LINCOLN ENGINEERING CO., 5702-46 Natural Bridge Ave., St. Louis 20, Mo., has designed an automatic high



High pressure booster gun

pressure booster gun for lubrication of bearings on industrial machinery requiring injection of a small quantity of lubricant at extremely high pressure. It can also be used as an auxiliary high pressure lubricator to service bearings requiring injection of limited quantities of special purpose lubricants, and to crack "frozen" or clogged bearings on contractors' equipment without the use of power-operated guns. The gun provides a complete range of pressures up to 10,000 p.s.i. The 2-lb. gun has a hydraulic coupler extension for reaching deep-seated and hard-to-reach fittings.

Small Riffle Sampler

PRECISION SCIENTIFIC CO., 3737 W. Courtland St., Chicago 47, Ill., has designed a small riffle sampler modeled to conform with the latest revisions of A.S.T.M. D271. The riffle sampler is used for accurate sampling of ore, sand, cement and similar granular or powered materials. Material poured in at the top is divided by twenty-four 3/8 x 4 1/2-in. rectangular openings and halved into representative samples. Material is removed from the drawers and poured again until an accurate laboratory sample is procured. The inner surface is of baked enamel to prevent clinging residues. The sampler is entirely enclosed. It is made entirely of 18 and 20 gauge sheet steel, with sections welded or bolted together, is 15 in. high, 11 1/2 in. wide and 14 in. deep.

High load-carrying all-steel pillow blocks

All-Steel Pillow Blocks

DODGE MANUFACTURING CORP., Mishawaka, Ind., has announced a new line of all-steel pillow blocks, providing high radial and thrust capacities. These new bearings are a joint achievement of Dodge and the Timken Roller Bearing Co. The bearings are fully self-aligning, with spherical outer race. They are available in both expansion and non-expansion types and have an adapter mounting. Double piston ring seals keep the lubricant in and dirt and dust out of the bearing mechanism. The bearings are sealed both on and off the shaft. They are available in shaft sizes from 2 1/16 in. to 10 in.

Industrial Loader

DEARBORN MOTORS CORP., Birmingham, Mich., has introduced a tractor-operated industrial loader, with a

Industrial loader mounted on small tractor

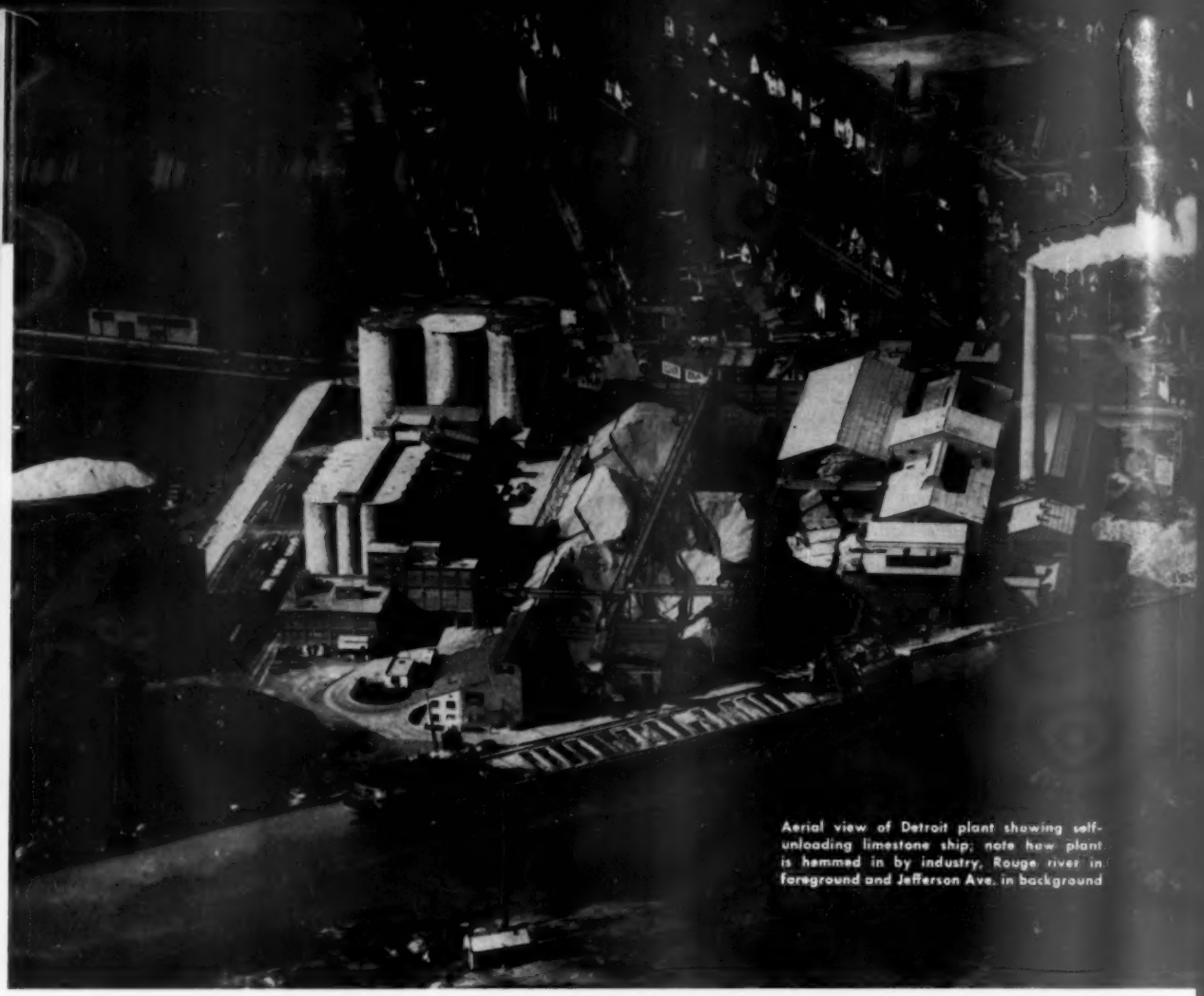
lifting capacity of 1/2 ton and a lifting height of nearly 11 ft. The loader is designed to be operated on a Ford tractor. Two levers give the operator "finger tip" control of the loader. The loader's hydraulic pump is mounted on the tractor rather than the loader itself, thus enabling the tractor to get closer to trucks for dumping the loader bucket. The loader will lift 9 cu. ft. or 1000 lb. of material and dump it at any height up to 10 ft. 8 in.

Scoop Shovel

THE THEW SHOVEL CO., 1000 E. 28th St., Lorain, Ohio, has announced the "Scoop Shovel" for use in underground or surface loading operations. The unit consists of a front end attachment that may be applied to any basic full-revolving TL-25 turntable. The attachment is interchangeable with standard shovel, crane, clamshell, dragline and hoe attachments. The shovel is equipped with a 1 1/4-cu. yd. dipper in place of the 3/4-cu. yd. dipper used on the standard TL-25 shovel. The attachment consists of a short boom 8 ft. 6 in. long, at the end of which is located a cable driven shipper shaft with pinions located at the outer ends. The dipper is attached to a double dipper stick which is crowded in or out in a telescopic manner through dipper stick sleeves fastened to the outer end of the boom. The underside of each stick is equipped with a rack or teeth which mesh with the pinions on the outer shaft; the dipper and dipper shaft may be crowded out or retracted. The scoop is capable of making three to four passes per minute. In underground operations it can travel through entries 9 ft. 6 in. high and can operate in headrooms as low as 10 ft. 6 in.

Front-end attachment for full-revolving shovel turntable

UNIVERSITY OF MICHIGAN LIBRARIES



Aerial view of Detroit plant showing self-unloading limestone ship; note how plant is hemmed in by industry, Rouge river in foreground and Jefferson Ave. in background

More Cement for Detroit Market

Peerless Cement Corp. increases clinker production at Port Huron for grinding in Detroit. Progressive improvements increase Detroit plant output

By BROR NORDBERG

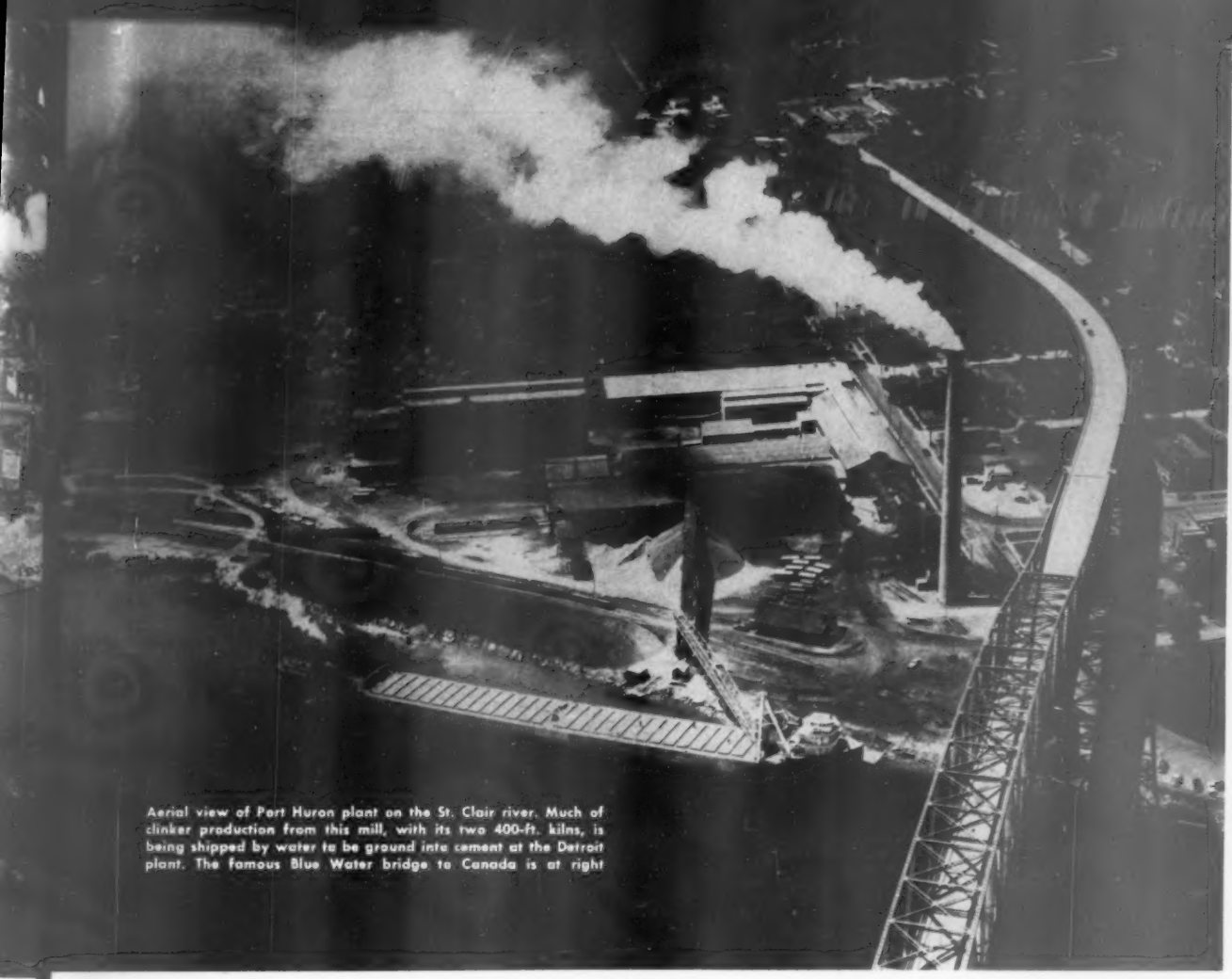
THE PORTLAND CEMENT industry has made great progress since World War II, in improving production costs and in adding to plant capacity where cement was short in supply and where future demands justified increased productive capacity. There have been new cement mills built while others have been practically rebuilt for increased production, but a very considerable part of the increased national productive capacity has come from older plants where progressive changes and general tightening up of production methods have accumulated to a substantial increase in output.

Peerless Cement Corp., with wet process plants within the city limits of Detroit, Mich., and at Port Huron, Mich., is an excellent example of how older plants, in spite of their limitations, have been converted to more economic production and increased output.

Detroit has been a critical area for cement almost since the end of the war. Not only had demands in recent years exceeded productive capacity of the Detroit plant but there has been a marked increase of bulk shipments. In 1946, about 34 percent of the mill's output was shipped in bulk whereas, this year, the proportion had increased to 70 percent. Eighty-five percent of the production is shipped by trucks, serving construction projects, concrete products and ready-mixed concrete plants within the city and in surrounding areas.

Part of the company's business is in Wayne county, of which Detroit is the hub, and much of the purchasing power of the entire state of Michigan is centered in the metropolitan area.

The challenge in cement manufacture, as a result, has been one of economic adjustment. More cement had to be made available in Detroit and Wayne county at favorable transportation rates, but the Detroit mill had limitations which have prevented substantial increase. It is located on the



Aerial view of Port Huron plant on the St. Clair river. Much of clinker production from this mill, with its two 400-ft. kilns, is being shipped by water to be ground into cement at the Detroit plant. The famous Blue Water bridge to Canada is at right

Rouge river in the western industrial section of the city on a site limited to 11 acres of land and is hemmed in on all sides. Increases to capacity, as a result, have been confined to enlargements and improvements limited necessarily to property restrictions.

The Port Huron mill is located on the St. Clair river some 50 miles northeast of Detroit. This plant was established primarily to serve southeastern and central Michigan throughout an area where transportation rates were favorable, but that area has not developed anything like the Detroit market.

Having increased the output of cement from the Detroit mill to the fullest possible extent, the company has recently completed a program to ship clinker from Port Huron to be ground into cement in Detroit. It involves increased clinker production at Port Huron, shipment of clinker to the Detroit plant by barge and enlarged finish grinding capacity in the Detroit plant.

Production of clinker at Port Huron has been increased by 1,000,000 bbl. annually with installation of a second 11- x 400-ft. rotary kiln, and approximately 1,000,000-1,200,000 bbl. of clinker will be barged to the Detroit plant for grinding into cement. The Port Huron plant now has a rated capacity of about 1,750,000 bbl. of clinker, the balance of which will be ground to cement and shipped from the mill.

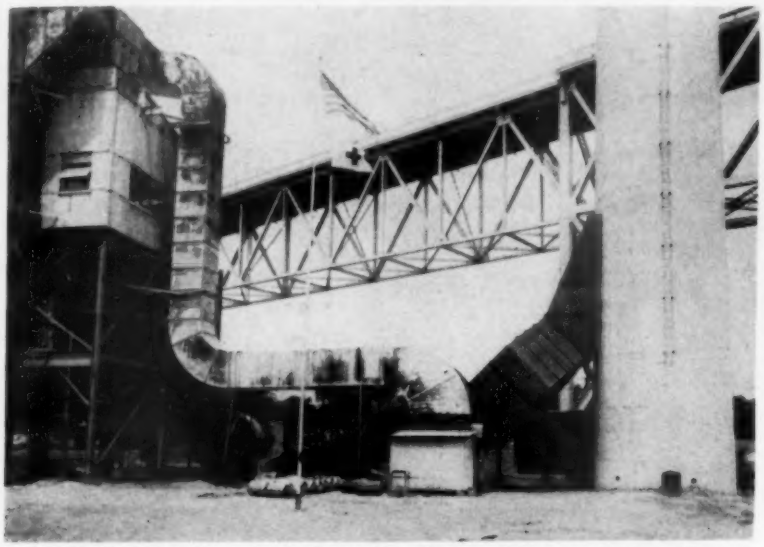
The mill in Detroit has had its annual capacity of cement increased by about 500,000 bbl. as the result of a series of improvements starting in 1946. Its rated capacity is now 2,000,000 bbl. of cement but grinding capacity is in excess of 3,000,000 bbl.

With this arrangement, to better serve the Detroit and Michigan market, the Port Huron plant has become largely a semi-processing operation, and the program over-all has been accomplished with comparative low capital investment per barrel of increased capacity.

Both plants are on navigable streams and receive their limestone and coal in self-unloading cargo ships, limestone coming from Calcite, Mich., and coal from nearby Lake Erie ports. Thus, it was convenient to install barge-loading and unloading facilities and it was decided to ship clinker rather than cement by water because of the greater economies. The Detroit plant is a waste-heat mill and had sufficient installed power-generating capacity for the increased grinding power load.

When facilities are finally completed, clinker will be conveyed into silo storage at Port Huron and barges will be filled by a tunnel belt conveyor. At the Detroit end an 8- x 10-ft. clinker receiving hopper has been installed which is filled by an American Steel stiff-leg derrick with a 50-ft. boom and 2-cu. yd. clamshell bucket. A 24-in. Barber-Greene portable belt conveyor transfers clinker from the hopper over the retaining wall into storage, where it is rehandled as required by the overhead bridge crane. A Hough Payloader is lifted into the barge by the derrick when needed for cleanup.

The company purchased a 35- x 195-ft. barge of 6000 bbl. capacity which is being sold to the contract hauler. The tow, by tugboat, through the St. Clair river, across Lake St. Clair and into the Detroit plant on the Rouge river, and return, requires 26-28 hr.

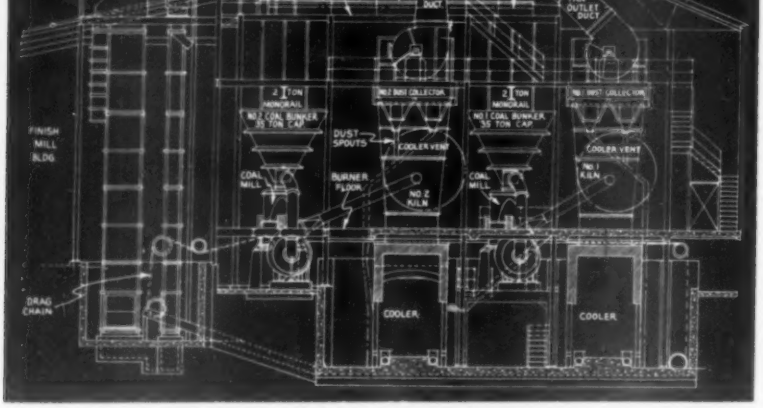


Both kilns exhaust through cyclone-type dust collectors and then to a common stack

Port Huron Kilns

Whereas the Detroit plant is waste-heat, Port Huron has two long rotary kilns. Originally, it had two 200-ft. kilns which were joined into a single 392-ft. long kiln in 1943 to conserve fuel (described in ROCK PRODUCTS, March, 1943, page 64). It has averaged 2400 bbl. of clinker per day. This kiln is to be modernized to increase production to 3000 bbl. which is the output of the new 11- x 400-ft. kiln. Changes to kiln No. 1 will include a new kiln section that will extend its length to 400 ft., and will require additional supports to make it a 6-support kiln and a drive to permit greater speed of rotation. Kiln No. 1 is being run at 54 r.p.h. with an exit gas temperature of 470 deg. F., as compared to 77 r.p.h. and an exhaust temperature of 620 deg. F. for No. 2 kiln. No. 1 and No. 2 kilns carry approximately 84 ft. of chain section. Modernization of kiln No. 1 will result in having approximately two identical kilns.

Both are Traylor kilns, the new one being of welded fabrication whereas the older one is of riveted construction with an improvised tandem drive. Each is fired by a Raymond No. 493 (14,000 lb./hr.) direct-firing unit bowl mill fed from 35-ton overhead coal bunker. Heated air is drawn from the kiln hood, vented through a clinker trap for dust removal, and swept through the coal mill according to standard practice in the industry. A 13,500 B.t.u. per lb. coal is used and is ground to a fineness of 90 percent minus 200 mesh as fired into the kiln at a controlled temperature of 180 deg. F. for the coal-air mixture. Coal comes in by self-unloading cargo ship and is handled into covered storage by a Caterpillar Carryall.



Sectional view of kiln building at Port Huron

Clinker Cooling

Along with installation of No. 2 kiln in 1951, an integral-type of air-quenching clinker cooler on No. 1 kiln was replaced with a 733 Fuller inclined-grate clinker cooler identical to that for kiln No. 2. Purpose of the change was to permit controlled preheating of greater quantity of secondary air and more effective cooling to temperatures (150 deg. F.) that permit immediate handling of clinker into the finish mill or to the dock for barge loading over belt conveyor.

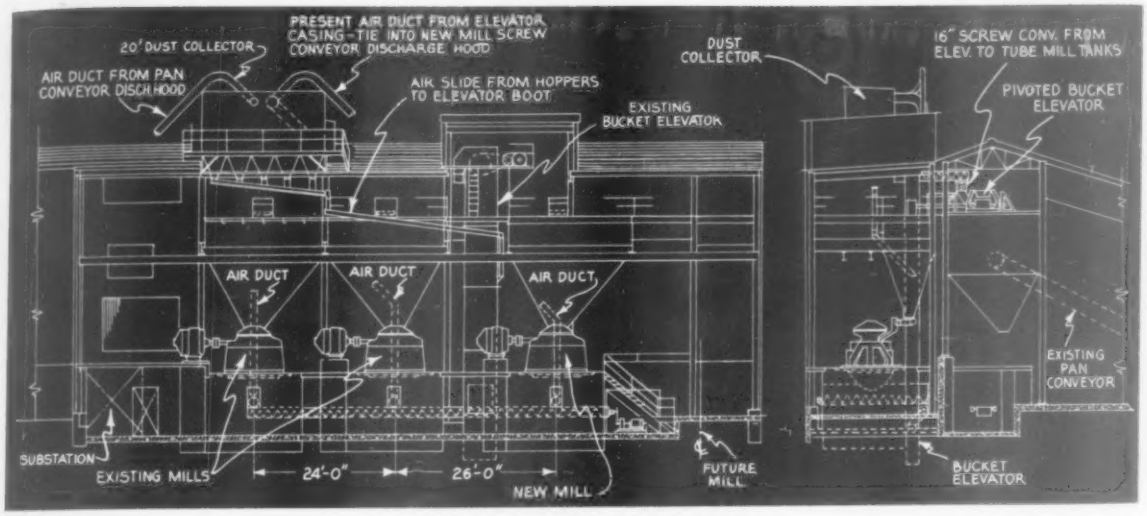
Coolers are equipped with radiation pyrometers above the grates for automatic regulation of grate speed to maintain a constant secondary air temperature. The holding point is 1000 deg. F. Cooling air is blown through the grate, in each case, by a New York blower rated at 43,360 c.f.m. (5-½ in. s.p. at 70 deg. F.). Of the total volume, approximately 17,000 c.f.m. enters the kiln as preheated secondary air, the balance being vented to the atmosphere. Each cooler has a hammermill-type clinker breaker at its discharge end, and a drag conveyor and elevator is the means of transfer of clinker into storage.

The kiln drive is synchronous with the ferris wheel slurry feeder in each case, the drive on the new kiln being a 150-hp., 600-r.p.m. Westinghouse motor with Falk spur gear, with alternator tied to the feeder drive.

Each kiln has a separate 125,000-c.f.m. American Blower Co. induced draft fan driven at 495 r.p.m. and has an independent Western Precipitation Corp. Multiclone stack dust collector on the suction side of the fan, but both exhaust through a common stack. A system is being completed whereby stack dust will be returned into the kilns continuously by interblending with the slurry feed. The company has had successful experience with burned basic brick for hot zone service and both kilns carry 40 ft. of basic brick starting 8 ft. back from the discharge end of the kilns. These brick start building a coating on the first heat and have been effective in building a good coating in 48 hr. as compared to a week for high alumina brick, according to experience at Port Huron. The basic brick is followed by 70 percent alumina brick, then 60 percent alumina after which cold zone brick extends into the chain section.

Both kilns have Leeds & Northrup opitcal pyrometers which record hot zone temperatures, L & N automatic draft control and Bailey continuous oxygen and combustibles analyzers. The holding point for O_2 is 2-2.5 percent. Practice is to hold the kilns

UNIVERSITY OF MICHIGAN LIBRARIES



General arrangement of finish mills at Detroit plant

at constant speed and adjust the fuel input to compensate for variations in the kiln.

Clinker is being produced at a fuel rate of 1,160,000 B.t.u. per bbl. with a slurry feed of 33 percent moisture.

Raw Grinding

Raw grinding capacity had to be stepped up proportionate to the increase in clinker production and was accomplished without the addition of any new grinding equipment. A third 7- x 26-ft. compartment mill was moved from the finish mill department, division heads were removed from the 3-compartment mills to convert them into 2-compartment mills, and two-stage grinding was adopted.

Practice had been to blend clay and limestone in the process of grinding through the two compartment mills. In order to grind the limestone to sufficient fineness, the result was overgrinding. Production was 77 bbl. per hr. per mill at a fineness of 89 percent through a 200-mesh sieve.

With the new arrangement, two 26-ft. dia. Traylor wash mills are being completed for high and low lime slurries. Previously, there was a single 20-ft. wash mill. Limestone slurry is being ground separately through two of the Compeb mills and drawn from two slip tanks to be washed with clay to the desired proportions in the separate wash mills. The mixed slurry, high or low lime analysis, as washed separately in the two wash mills, is then ground through the third mill, separately, into high and low analysis slurries.

Separate grinding of limestone into slurry, alone, has resulted in a 20 percent increased output according to experimental runs. With two-stage grinding, the product is being ground to 85 percent minus a 200-mesh sieve as compared to 89 percent through a 200 mesh with a blended mill feed. A fineness as coarse as 82 percent through a 200-mesh sieve has been determined satisfactory to produce a sound clinker well within limitations established for free lime. Limestone is ground in the preliminary mills to a fineness of 73 percent minus 200 mesh at the rate of 32 t.p.h. per mill. It is washed with a clay of 94 percent minus 200-mesh fineness. Production is now 250 bbl. per hr. through the third mill. High and low lime slurries are blended, the corrected slurry is transferred into kiln feed tanks and pumped into the ferris wheel feeder tanks. Further study of power demands will determine whether or not it will be desirable to operate the preliminary mills in closed circuit.

About 500,000 bbl. of cement will continue to be ground annually at this plant. Standard and air-entraining portland cements are produced. Finished cement storage capacity is 200,000 bbl. in silos and 75 percent of the shipments are in bulk.

One of the direct-firing unit coal mills

Detroit Mill

Aside from the recently completed finish grinding mill and special facilities to handle clinker from Port Huron, the Detroit plant has undergone many changes during the postwar years. The mill was established in 1925 as a wet process, waste-heat boiler operation. As costs of fuel and power increased and as new technological advances became available to the industry, necessary changes have continued to be made to keep pace with the industry and to increase output.

Space limitations have been a serious handicap and have had their influence on equipment selection. Usually, installations have required considerable engineering ingenuity in order to fit them into limited space.

The original three kilns are still in service but, since World War II, their production has been increased from 4000 bbl. to 5400 bbl., or 467 bbl. per day per kiln, which production compares very favorably with many of the long modern rotary kilns which have been installed at great expense. The kilns have direct-firing 47-in. B & W coal mills at their front ends, Fuller inclined-grate clinker coolers below, slurry filters above, and superheaters, waste-heat boilers, economizers, stack dust collectors and induced draft fans at the rear end. None of the equipment that has been added in recent years has contributed to increased length of the over-all kiln installations.

Direct-firing coal mills and integral type air-quenching clinker coolers were added prior to the war. At that time, the effective length of the kilns, which are of Traylor manufacture, was 169 ft. which has been increased to 178 ft. by the substitution of 7- x 20-ft. Fuller air-quenching, inclined-grate clinker coolers. Each kiln has its original 1000-hp. Ladd waste-heat

boiler, 9-ft. Sturtevant draft fan, and has a 21-tube Western Precipitation Corp. Multiclone stack dust collector.

Like many other waste-heat plants, the addition of various equipment over the years had increased the power load and it became necessary to purchase supplemental power. In addition, coal costs started to spiral after World War II and the demand for cement also increased.

The result was installation of slurry filters in 1946, the rewinding of the kiln drive motors to step up the speed from 40 r.p.h. to 60 r.p.h. and installation of modern turbo-generators to require less steam per unit of power generated. Each kiln has two 8-disc Oliver United filters of 12 ft. 6 in. dia. which have reduced moisture content of the kiln feed from 38 percent to 21 percent moisture. Since this installation was described (see ROCK PRODUCTS, August, 1948, pp. 134-136), ribbon screw conveyors have replaced belt conveyors in carrying the filter cake into pug mills where stack dust is introduced to produce a granular feed. Ribbon screws minimize variations due to large chunks of cake. The dust requirement for the required granularity is 65 lb. per bbl.

At first, the problem was to produce sufficient dust. It has been found that by holding the silica ratio of the clinker up to 2.15-2.30, sufficient dust is obtained for optimum filter operation. When the silica ratio is lower, a correction is made by adding sand into the clay mill. A 325-mesh waste polishing sand is trucked in from an industrial plant for the purpose.

The combination of filters, increased kiln speed and two new 3750 kv.-a. turbo-generators which require only 12.5 lb. of steam at 200 p.s.i. to generate one kilowatt of power as compared to 17.5 lb. with the old units, accomplished three objectives. The plant became self-sufficient in power, coal consumption was reduced by 30 percent and production was increased from 4000 to 4600 bbl. per day from the three kilns. More recently, production was jumped to 5400 bbl. since installation of the inclined grate coolers, by virtue of increased effective kiln length and the increased draft now carried.

Before slurry filters, the new turbines and clinker coolers were installed, the fuel requirement was 1,500,000 B.t.u. per bbl. of clinker produced, of which 18 percent was chargeable to the auxiliary boiler. Steam production was 1,000,000 lb. per day from the waste-heat boilers and 1,000,000 lb. from the auxiliary boiler. Power production was 100,000-110,000 kw.-hr. per day. Now, the steam requirement is 1,600,000 lb. per day to produce 150,000 kw.-hr. and the over-all fuel requirement is 1,350,000 B.t.u. per bbl. of clinker produced.

Clinker Coolers

The 7- x 20-ft. Fuller coolers are reverse flow and are supplied cooling air by New York blowers rated 30,000 c.f.m. at 6½ in. s.p. and 90 deg. F. A Reeves vari-speed drive on the grate is the means of regulation to maintain secondary air temperature for the kiln at 1000 deg. F., as measured by thermocouple over the clinker bed at the hot end. Excess cooling air is exhausted after passage through a Multiclone stack collector. The collector fan is a 30,000-c.f.m. Sirocco fan and the dust returns to the clinker stream from the cooler.

An interesting feature is the clinker chunk breaker installed on the discharge end of the cooler. It consists of two 16-in. dia. cylindrical rolls on 22-in. centers. The rolls have 16 nobs, eight of which are 1¼ in. sq. and eight are ¾ in. sq., alternating and spaced equally around the rolls. Clinker passing over the last grate section of the cooler, of 3¾ in. top size, is put through the breaker. These rolls are driven at 131 r.p.m. through V-belt and spur gear, in the opposite direction to normal rotation for rolls. It was discovered, by accident when installed, that this reverse action is very effective in breaking clinker chunks. The motor is 10 hp. and the actual power required is 6 hp. One foot of the cooler length had to be cut in order to install the breaker which terminates at one of the kiln piers.

Finish Grinding

Clinker grinding capacity has been increased from 6000 bbl. a day to 10,000 bbl. by substitution of two-stage grinding for single-stage, which was with compartment mills in closed circuit with mechanical air separators. Under the old system, there were four 3-compartment mills. Each mill produced 65-75 bbl. per hr. of cement.

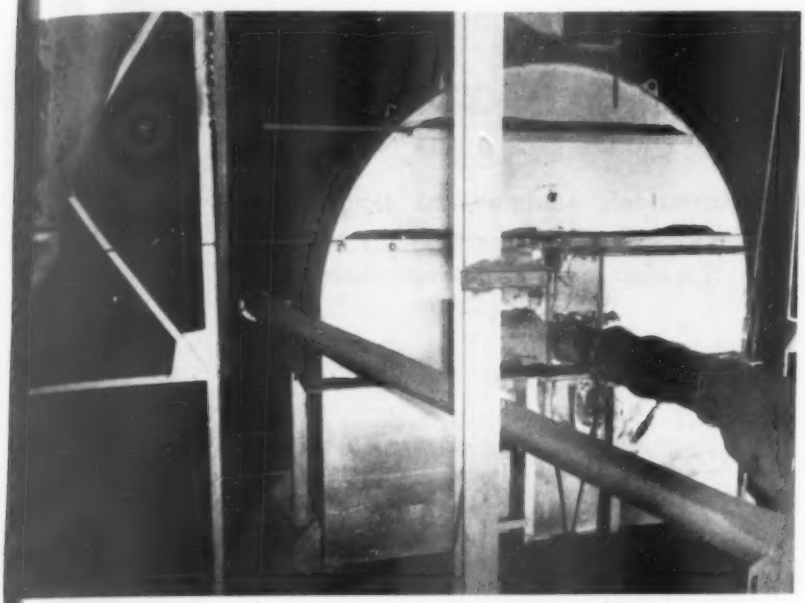
With the need for capacity increase, the mill building was extended and two type H Bradley Hercules mills were installed for preliminary grinding. A third preliminary mill has recently been added for increased capacity and reserve. The four compartment mills were converted into straight tube mills by removal of the division heads, the four being run as finish mills with each pair of two in closed circuit with a 16-ft. Raymond mechanical air separator.

Clinker is ground to 600-800 Wagner surface area through the preliminary mills at the rate of 190-195 bbl. per hr. each. Each finish mill is producing cement at 100 bbl. per hr. With two-stage grinding, the power requirement for finish grinding has been reduced from 7 kw.-hr. to 6 kw.-hr. per bbl.

Space limitations were a consideration in the selection of type of mill and in conveying methods, space overhead being tight to accommodate feed bins. Clinker is reclaimed from covered storage by pan conveyor and put over a vibrating scalping screen on the way to a Traylor TY gyratory crusher. Oversize is reduced to 1-in. top size, joins the throughs, and the clinker is elevated by a Peck pivoted bucket conveyor for transfer into the Bradley mill feed bins. A relatively new conveyor for the cement industry is used to fill the Bradley mill feed bins from the pivoted bucket conveyor. It is a vibrating conveyor, manufactured by the Carrier Conveyor Co. and is described as a "natural frequency" conveyor. Consisting of a steel trough supported on heavy coil springs, it is designed to operate at the natural frequency of the springs.

View of new 400-ft. kiln taken from firing end

UNIVERSITY OF MICHIGAN LIBRARIES



Hood of one of two 400-ft. kilns showing optical pyrometer and, on left, clinker dust trap in hot air line to direct-firing coal mill

on the theory that only sufficient power is required to convey the material. The conveying force is stored up in the springs and is returned on every stroke like the principle of the flywheel. These conveyors were selected because they require little headroom. They are 16 ft. in length, are driven by 3-hp. motors and deliver clinker into the mill feed bins at the rate of 500 bbl. per hr.

Preliminary mills are driven by 350-hp. motors through flexible couplings. Feed is regulated through 2-speed belt feeders which have d-c drives tied to maintain a preset amperage on the mill motor drive. Mill product is conveyed by cross screw conveyors to a main screw conveyor, then elevated and transferred into the tube mill bins by screw conveyors. The preliminary mills are air-swept by a 20-ft. type 360 Sly dust collector to hold the temperature down and to keep the discharge screen clear. Dust is returned by Airslide into the elevator carrying the mill product overhead to the tube mill bins.

Gypsum by-passes the preliminary mills and, after being crushed through the Traylor crusher, is elevated and transferred into special hoppers from which the tube mills are fed. Cement is conveyed into the silos either by F-K pump or by a system of screw conveyors and bucket elevator. Storage capacity is 450,000 bbl. in two banks of silos. The packing plant was designed from the beginning for truck loading, and has two bulk cement truck loading scales, seven Bates and two Modern packing machines. Standard, air-entraining and high early strength portland cements, also mortar cement, are manufactured at this plant.

Officials

W. C. Russell is president of Peerless Cement Corp. which has its headquarters in Detroit. L. F. Lawler is vice-president in charge of sales, W. L. Kaiser vice-president in charge of manufacturing, A. C. Eichenlaub, director of operations, M. M. Sepic, secretary and treasurer, J. W. Stead, assistant secretary and purchasing agent, G. C. Beld, assistant sales manager, and H. L. Henson, chief engineer.

C. J. Line is superintendent of the Detroit plant, C. V. Palonen is chief chemist and M. A. Percival is plant engineer. Ray R. Adams is superintendent at Port Huron, S. L. Myers is chief chemist and William Gabbe, Jr., is plant engineer. H. L. Vanderwerp is technical director for both plants.

Indian Plant Makes Fertilizer From Gypsum

A RECENTLY COMPLETED $50,000,000 plant at Sindri, Bihar, India, is now producing ammonium sulfate at the rate of 350,000 tons per year, an amount sufficient to meet one-seventh of the nation's fertilizer needs. Principal raw materials are gypsum and coke. The reaction takes place between ammonium carbonate and the calcium sulfate. It is planned to build a plant to utilize the by-product calcium carbonate in producing 300 t.p.d. of portland cement.

Much of the design of the plant was done by an American company, Chemical Construction Corp. (American Cyanamid subsidiary). The company also supervised construction for the government of India.

Sand Moisture Studies

E. L. HOWARD, testing engineer, Pacific Coast Aggregates, Inc., San Francisco, Calif., recently completed a report on his studies of problems relating to the control of moisture content in concrete aggregates. Some of the factors investigated included: variation in moisture content at various plants as determined by routine samples; change in moisture content from the point of production to the point of use; variation in moisture content at different levels of the stockpile; and the amount of time required for drainage under various conditions. Mr. Howard concluded that sand moistures, as delivered to the batching plant, can be controlled within reasonable limits if:

1. All shipments are loaded from stockpiles that have been moved at least once, leaving the very wet bottom level.
2. All shipments are loaded from bunkers that are provided with gates designed to carry away most of the excess water and are active enough to prevent the accumulation of water in the area above the gates.
3. Shipments are not partly from stockpile and partly from bunkers.
4. All shipments are made either by rail or highway transport, not combination of the two.

It was further reported that all batching plants, which have received sand as suggested above, have ceased to complain about moisture inconsistencies.

Perlite Fire Tests

PERLITE INSTITUTE and Metal Lath Manufacturers Association, co-sponsors of a research and fire testing program, have announced that lightweight perlite columns designed to provide 2-, 3- or 4-hr. fire protection for structural steel columns have passed final fire tests at the Underwriters' Laboratories in Chicago. Final tests in the recently completed series showed that a thin, 1⅝-in. coating of lightweight perlite-gypsum on self-furring metal lath is sufficient to provide 3½-hr. fire protection for steel columns. In previous tests using the same basic construction, a 1-in. thickness of perlite-gypsum plaster received a 2-hr. fire retardant rating, while a 1¾-in. thickness was given a 4-hr. rating, maximum required by any building code in the United States.

A standard mix of 2 cu. ft. of perlite plaster aggregate to 100 lb. of fibered gypsum plaster is used for the scratch coat, while the second or brown coat is made up of 3 cu. ft. of perlite to 100 lb. of gypsum plaster. Because of the lightness of perlite, the total thickness of the brown coat can be applied in one operation without the wet plaster rolling or sagging. A standard white finish is applied after the brown coat has set.

UNIVERSITY OF MICHIGAN LIBRARIES

Agricultural Liming

Survey of Liming Materials Use

National Lime Association's summary of long-time trends in use of agricultural liming materials by states shows how essential it is that industry promote their use

By ROBERT S. BOYNTON*

STATISTICS WITH their endless masses of figures (usually of high denomination) are generally a boring subject. Yet, this much maligned activity is being employed more and more by business generally. Most large companies defer making decisions or establishing policies until all available statistics directly or indirectly related to the problem are analyzed and interpolated. It is either or both a brave or foolhardy executive who determines the course of action in conflict with his statistical analyses.

Historical Background

The available statistics on the consumption of agricultural liming materials present a surprisingly interesting story. This summer the National Lime Association published its 23rd consecutive annual summary of agricultural liming materials by states. This study is easily the oldest and most widely used survey on liming materials, being utilized by government (U.S. Department of Agriculture) and industry alike. It is interesting to note that in spite of the propensity of the U.S.D.A. for vast and varied statistical studies, including fertilizers, it has never penetrated this field which the National Lime Association initiated in 1929. Apparently it is satisfied with the National Lime Association's annual estimate. Incidentally, this N.L.A. survey was originally conceived and initiated by the liming materials industry's old friend, the late Henry A. Huschke, in his position as head of the Agricultural Department of the National Lime Association.

1951 Liming Figures

Before delving into the statistics of the past 23 years of this industry, it would be well to review the past year. For the country as a whole, 1951 proved to be about the same as the previous year (see Fig. 1) with a total consumption of liming materials of 26,585,000 tons representing an infinitesimal increase of about 50,000 tons over 1950. Sectionally there was a substantial gain in the south of about 25 percent. The western section also reflected an increase of about 14 percent, and the northeast enjoyed a slight gain of approximately 5 percent. Losses occurred in the two biggest lime consuming sections, the east central and north central areas, of approximately 3 percent.

The most pronounced consumption gain occurred in Arkansas, amounting to about 126 percent. However, the greatest tonnage increase of 324,000 tons occurred in Ohio. Florida, Georgia, Texas, Nebraska, New York, and Kansas all showed sizable increases.

On the debit side the biggest tonnage losses occurred in Illinois and Missouri. However, Illinois still clung to its position as the leading state for liming materials in spite of an increase by second place Iowa. South Carolina and North Carolina both had marked decreases. Smaller losses occurred in Vermont, New Jersey, West Virginia and Tennessee.

National and Sectional Picture

It is common knowledge how the consumption of lime has skyrocketed in all sections of the country during the past 15 years, a fact which is clearly reflected in Fig. 1. The first big jump occurred in 1936 when the total consumption figure was estimated at nearly twice that of the preceding year. The year 1936 also marked the first federal subsidies on liming materials by the then government A.A.A. program.

However, how many of the current liming materials producers are familiar with this industry's consumption history before the introduction of federal subsidies? After all, probably a large majority of current producers were not even in the business before 1936. Do they know that the consumption of liming materials in the depth of the depression was less than one-half that of 1929?

These and many additional questions are answered by examining the consolidated results of the 23-year survey. While the industry has boomed for the most part during these 23 years, business has not always been a "bed of roses" as these statistics clearly reveal. Of course, many trends are easily discovered, but noteworthy exceptions exist to all trends. At the very best it is a highly unpredictable business, and undoubtedly constitutes a more "feast-or-famine" type of market than the other major uses of limestone. Different from other uses of lime and limestone is the fact that in the same year one state can be enjoying a tremendous demand for liming materials while another state, often nearby, is suffering from badly depressed market conditions.

Paradoxical Markets

There are many examples of this paradoxical situation. In Fig. 4 note that while Iowa was suffering a drastic decline in 1936 of about 82 percent, the neighboring middle western states of Illinois and Ohio had increases of 22 percent and 23 percent respectively. Also in 1936 it is shown in Fig. 5 that Tennessee's consumption skyrocketed about 410 percent while its neighbor, Kentucky, decreased 19 percent; during the same year another large consumer, Pennsylvania, gained 48 percent. More recently in 1944, in Fig. 6, Indiana showed a marked increase of 66 percent while its midwest neighbor, Missouri, dropped 15 percent. Such paradoxical examples are not sectionalized and occur from coast to coast. In 1940 Vermont increased its consumption by about 100 percent (Fig. 7) at the same time its neighbor, Massachusetts, declined 18 percent. In the same figure in 1937 while Oregon increased 108 percent California dropped 37 percent. Even more extreme exceptions can be found in Fig. 8. In 1944 while Oklahoma had a sharp loss of 20 percent, its big neighbor to the south, Texas, increased at the amazing rate of 937 percent. However, this is somewhat misleading since the previous year Texas used scarcely any liming materials and in 1944 simply started liming for the first time.

However, these strange exceptions occur in sections as well as states, as can be seen in Fig. 2. In 1937 both the middle atlantic and southern states increased substantially by 40

*General manager, National Lime Association, Washington, D.C.

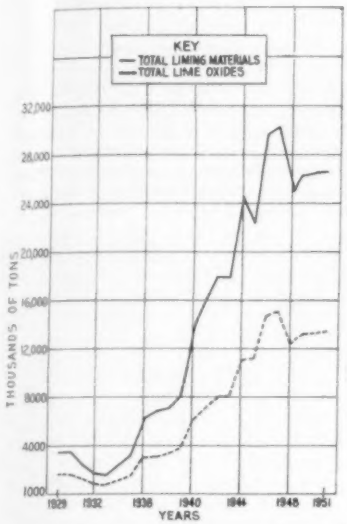


Fig. 1: Liming consumption trends in the United States for the period 1929-1951

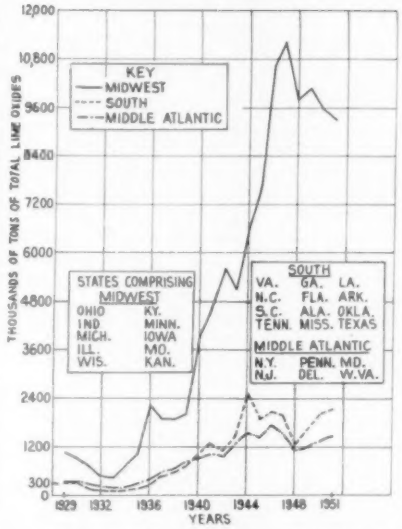


Fig. 2: Liming consumption trends for the Midwest, South and Middle Atlantic states

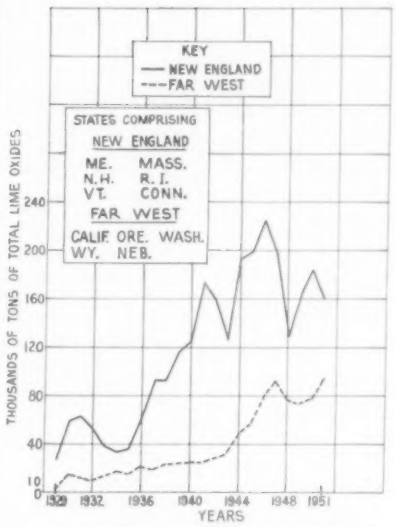


Fig. 3: Liming consumption trends for the New England and Far Western areas

percent and 90 percent respectively while the midwest actually decreased 15 percent. This decrease occurred in spite of the fact that federal subsidies were gaining momentum in their second year of existence. Consequently, about the only consistent factor in the agricultural liming business is these strange exceptions that occur each year.

Although many of these sharp and sudden declines and increases are difficult if not impossible to explain looking back in retrospect, at the time they occurred there were probably advanced very plausible reasons for these happenings. Inevitably, the two dominant reasons for changes in markets, whether of a positive or negative nature, are the extent of federal subsidies on lime, and weather.

Effect of Federal Subsidies and Weather

Without a doubt the major reason for the approximate seven-fold increase in consumption since 1935—at least 90 percent so—was the introduction of federal subsidies under the old A.A.A. program and more recently carried on by the P.M.A. (Production and Marketing Administration). Thousands of farmers used liming materials on their farms for the first time due to the incentive of Uncle Sam paying a half or more of the cost.

Consequently, when the A.A.A. or P.M.A. divert some of their funds previously earmarked for liming to other conservation practices, like phosphates, terracing, dam construction, etc., liming material consumption suffers. Conversely, liming is and has often been one of the key agricultural programs for certain states, and is and has been vigorously promoted by the state experiment stations, county agents, and the P.M.A. working together. The natural result is an upsurge in consumption. Such concerted promotion may last for 1 to 5 years or until another agricultural service appears more urgent to the state's agricultural powers. Then the emphasis suddenly shifts, with a resulting decline. Of course, another obvious factor is the over-all appropriation to the P.M.A. for these agricultural services, and generally the annual consumption of limestone has closely coincided with the increases and decreases in the annual P.M.A. appropriation.

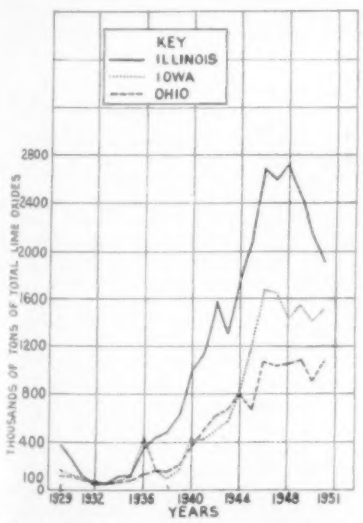


Fig. 4: Comparison of liming consumption for the states of Illinois, Iowa and Ohio

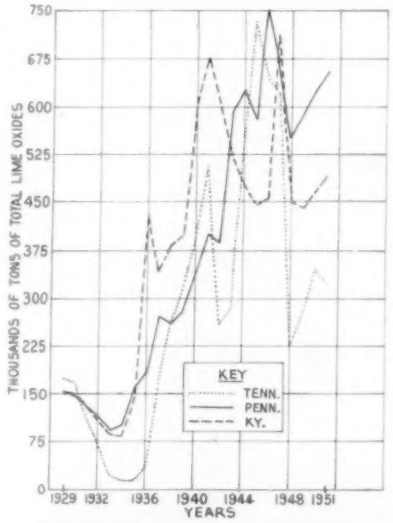


Fig. 5: Comparison of liming consumption for Tennessee, Kentucky and Pennsylvania

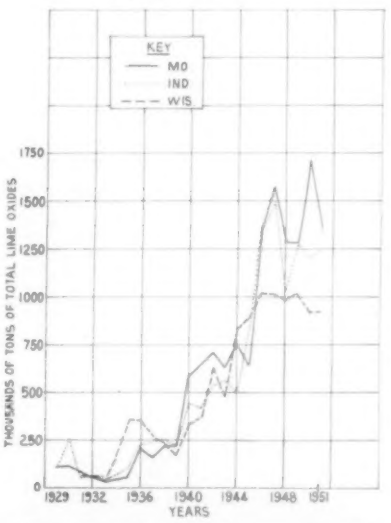


Fig. 6: Comparison of liming consumption for Missouri, Indiana and Wisconsin

Unfortunately this cannot be proved statistically since during the A.A.A. and even in the early years of the P.M.A. the government did not retain records of the tonnages of liming materials that were subsidized. It would be a reasonable conjecture, however, to speculate that had such figures been retained or compiled the amount of money annually spent on liming would have closely paralleled the annual consumption figures revealed in Fig. 1. One recent example to support this premise was the rather drastic decrease of over 5,000,000 tons that occurred in the country as a whole from 1947 to 1948. Coinciding with this loss was a sharp cut in over-all P.M.A. appropriations.

The second major factor affecting the situation is as unpredictable as its name—weather. Often ill-timed rains have interfered with liming to such an extent that a state's appropriation for liming materials is not completely utilized during a year. Consequently, weather can even negate the effect of high government subsidies.

State Leaders in Liming

In recent years Illinois has consistently been the largest consumer of liming materials, generally by a wide margin. In addition these consolidated figures reveal that Illinois during the first year of the survey—1929—was also first in the country. Table I shows how the ten largest consuming states ranked during 1929 and in the past two years, 1950 and 1951.

However, Illinois has not always been the "kingpin." There have been six out of the 23 years of the survey that Illinois was not first, during the years 1931-36 inclusive. In fact, in 1932 Illinois was only 11th, although in the other five years this state was always among the top four states.

Table I. Ranking of states in liming material consumption

	1929	1950	1951
1.	Illinois	Illinois	Illinois
2.	Iowa	Missouri	Iowa
3.	Tennessee	Iowa	Missouri
4.	Kentucky	Indiana	Indiana
5.	Pennsylvania	Wisconsin	Ohio
6.	Ohio	Ohio	Wisconsin
7.	Missouri	Pennsylvania	Pennsylvania
8.	Indiana	Kentucky	Kentucky
9.	New York	Virginia	Virginia
10.	Virginia	North Carolina	New York

Who do you think replaced Illinois as the liming leader during these six years? The answer is rather surprising when compared with current liming statistics. In 1931-33 inclusive it was Pennsylvania; in 1934 and 1935 it was Wisconsin and in 1936 Iowa rose to the top. During these years Kentucky consistently ranked high, finishing second quite a number of times—but never quite first.

Fluctuating Demand

During these 23 years most states' consumption has drastically increased in spite of the inevitable fluctuations. However, there are even exceptions here. In Fig. 7 note that Massachusetts and California's consumption is still about the same today as it was in 1929. Liming in these two states has been static and simply has not "caught on" as with most others. Of course, California can probably point to its alkaline soils as the reason for its failure to expand. Yet, other alkaline soil states, like Texas (Fig. 8) and Oregon (Fig. 7) have increased considerably. Compare the static state of Massachusetts with its steadily growing neighbor, Vermont.

Most states show marked fluctuations in use, as already mentioned. Yet, for "blowing hot and cold" it appears from Fig. 5 that Tennessee probably has no equal. Note that during this span of years consumption has shot up spectacularly several times only to plummet far down again.

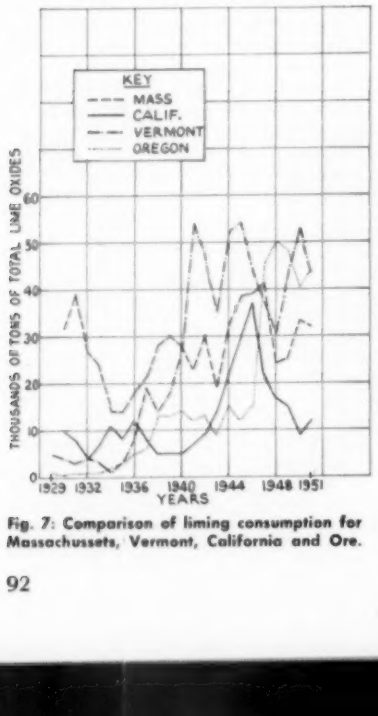


Fig. 7: Comparison of liming consumption for Massachussets, Vermont, California and Ore.

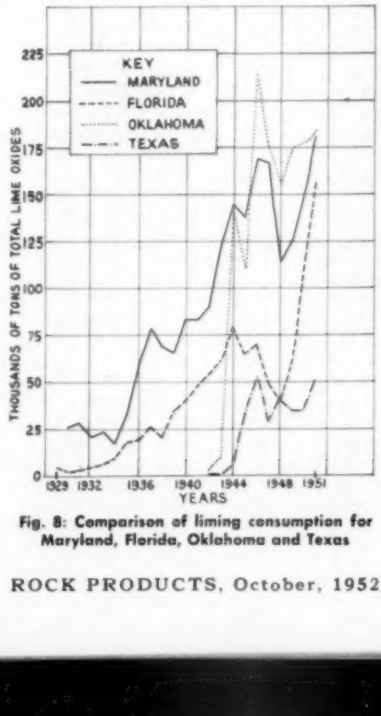


Fig. 8: Comparison of liming consumption for Maryland, Florida, Oklahoma and Texas

Note the difference in Fig. 5 in the extent of "ups and downs" of Pennsylvania in particular and, secondly, Kentucky.

Some of these rapidly fluctuating states must place quite a strain on the liming producers. In the case of Tennessee expanded production facilities undoubtedly accompanied these sudden spectacular spurts in demand. Yet, before additional hammermills, jaw crushers, and shovels can be amortized the big demand suddenly withers away. It is no wonder that the agricultural liming industry has had a rather large number of business failures.

Effect of Depression and War

As would be expected, most states showed reductions in varying degrees during the great depression of the early thirties. Yet again there were a few exceptions to this. An example is Florida (Fig. 8), which actually increased at least slightly every single year after 1930 until 1937. For a state affected the worst by the depression, again probably Tennessee should be selected (Fig. 5). From 1929 to 1934 consumption shrank to less than one-fourth of the 1929 tonnage. However, Illinois suffered quite drastically—much more than Iowa or Ohio (Fig. 4). The adverse effect of the depression on Maryland was only very slight, as can be seen in Fig. 8.

During World War II for the most part liming material consumption continued to forge ahead. Federal subsidies, as might be expected, were quite liberal since the U.S. was of course particularly anxious to augment and safeguard its food supply. About the only deterrent as a whole to the liming industry was the prevailing manpower shortage. Consequently, had labor been more plentiful, more farms would have been limed than was the case. However, the same situation applied nearly as much in harvesting crops and other agricultural activities.

What's Ahead?

It has been estimated by many agronomists that the current U.S. liming material consumption is only about one-half of the annual loss of limestone on the U.S. farms each year. Consequently the replacement of this loss of 55,000,000 to 60,000,000 tons of limestone equivalent is a logical sales goal for the U.S. liming materials industry, as well as for the agronomists. How this can be done is really "a $64 question." Yet, it is increasingly evident that the liming materials industry is not going to depend as much on the crutch of federal subsidies to strive for this goal. In the past few years the industry has shown ample evidence that it can and will promote liming successfully to the farmers. Radio commercials have

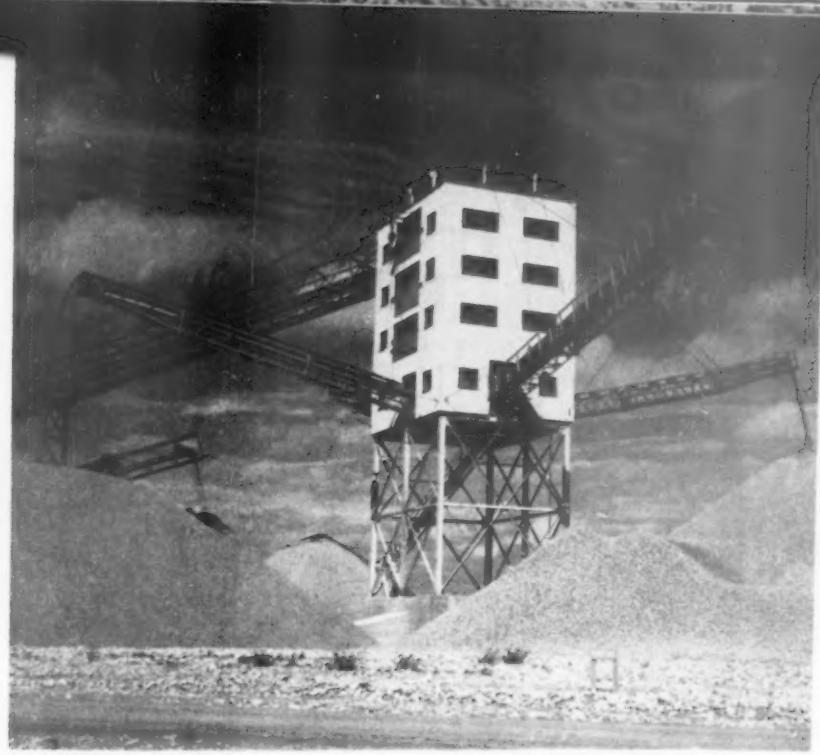
(Continued on page 134)

UNIVERSITY OF MICHIGAN LIBRARIES

Right: Stacker tower showing the four stacker belts, conveyor No. 4 from secondary crusher building, stockpiles and part of recovery tunnel

Below: View of transfer tower between conveyors No. 7 and No. 6 in secondary crushing circuit

Bottom: A shovel loads to a mobile field hopper (background) at the end of the field conveyor, which discharges to conveyor No. 8 at the right



GRAVEL PLANT DESIGNED FOR GROUND STORAGE

Consolidated Sand and Gravel Limited segregates production from loading operations for simplified large capacity plant

By J. T. MOGAN*

ON JULY 9, 1952, Consolidated Sand and Gravel Limited officially opened a new sand and gravel plant near Paris, Ontario, Canada. (See ROCK PRODUCTS, August, 1952, page 160). The company is a wholly owned subsidiary of Standard Paving and Materials Limited of Toronto, Ontario, and had previously owned and operated three other sand and gravel plants.

Capacity of the new plant is 350 t.p.h. in production and 400 t.p.h. in loading either railroad cars or trucks. The plant was built to meet an increasing demand in Ontario for specification materials and to compensate for depletion taking place at the other three plants. One of the other plants operated by this company is also located near Paris.

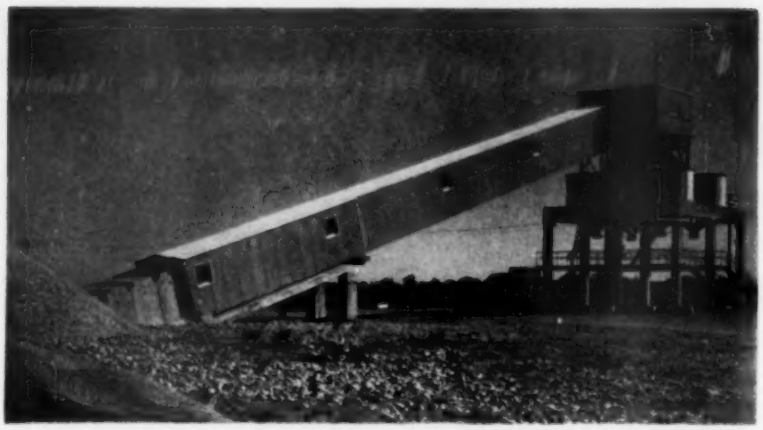
The most outstanding feature of this plant is the method adopted for stockpiling coupled with the method of recovery from stockpile and loading. Recovery and loading are separate from and independent of the production process, so that either may be carried on alone.

The plant is located on a property of about 350 acres. The material being processed is approximately 50 percent gravel and 50 percent sand. It is of glacial origin and varies in depth from 30 to 50 ft., underlaid with clay. The maximum size of gravel is about 16 in., and the largest fraction of gravel material is limestone.

In May, 1951, stripping the overburden was begun and work has been proceeding ever since. Structurally the plant is of concrete and steel throughout. The main buildings are sheeted with corrugated asbestos. The plant is located near the confluence of the Grand and the Nith rivers, all the wash water for the plant being pumped from the latter. Except for the shovel, the plant is completely electrified, power being supplied by the Hydro-Electric Power Commission of Ontario. Situated on the main line of the Canadian National Railway, the plant was designed primarily for railroad car loading, although provision has been made for truck loading as well.

Material from the bank is dry excavated and discharged through a mobile hopper to a 36-in. conveyor belt (No. 8) traveling about 350 f.p.m. Conveyor No. 8 and the field conveyor are lengthened as the bank is excavated. The discharge end of conveyor No. 8 is in the primary crusher building directly over a 5- x 12-ft. Ty-Rock F-600 double-deck scalping screen. Oversize material from the

*Assistant manager, Consolidated Sand and Gravel Ltd., Toronto, Ont., Canada.



Loading station showing four loading bins at the right for railroad cars; bins are also equipped with chutes for loading trucks. Gallery at left goes to the recovery tunnel under the stockpiles

scalping screen is chuted to the primary crusher, a 4-ft. Traylor type TY gyratory crusher. The crusher discharge is chuted to the tail end of a 36-in. belt conveyor (No. 6), the discharge end of which is at the upper level of the secondary crusher building. Material passing the scalping screen is conducted via chutes and a transition box back to conveyor No. 6, where it rejoins the material which has been crushed.

From the discharge end of conveyor No. 6, the material is fed through two transition boxes and a splitter to two Ty-Rock F-600, 4- x 14-ft. three-deck screens. The transition boxes and the secondary screens operate wet. Wash water is distributed through perforated pipe and Link-Belt spray nozzles. Sand is carried with the wash water through the bottom deck of the secondary screens to an 18-ft. dia. Dorr Type AX hydroseparator. Underflow from the hydroseparator, controlled by a Massco-Grigsby pinch valve, goes to a Dorr Type DSFX 8- x 24-ft. rake classifier. The dewatered sand is delivered to an inclined 24-in. belt conveyor (No. 5) which discharges to a stockpile. The sand stockpile is located over a section of recovery tunnel No. 1. Overflow from the hydroseparator and classifier are wasted through a 15-in. concrete pipe outfall line to a tailing pond in the Nith river flats. Water seeps back to the river.

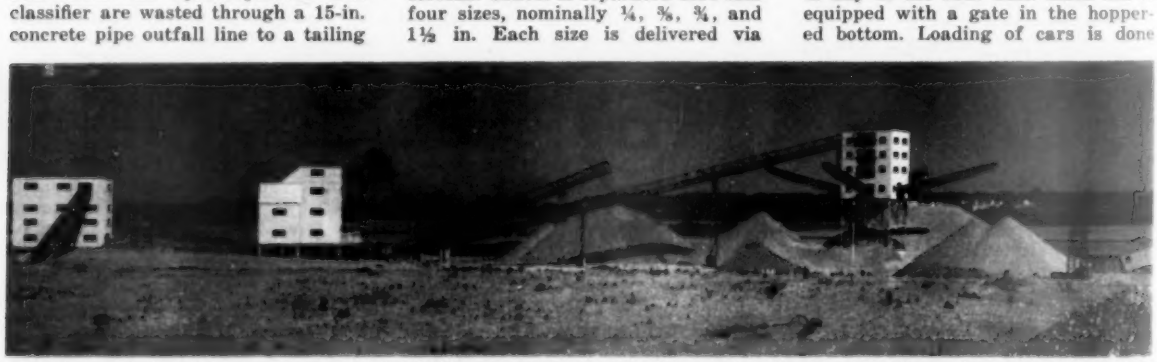
Oversize from the top deck of the secondary screens may be chuted to the rinsing screen or to the secondary crushers. The latter are two 36-in. Symons standard cone crushers, discharge of which drops to a 24-in. belt conveyor (No. 7), which in turn discharges over a transfer tower back to conveyor No. 6, thus closing the circuit. Use of secondary crushers is dictated by the quality of material being excavated and by customer demand for 1½-in. stone. Material from the middle and bottom decks of the secondary screens is chuted directly to the washing screen. Final rinsing of all gravel is done on a Symons 4- x 12-ft. Type F double-deck vibrating screen. It also acts as an offbearing conveyor, discharging the washed gravel through a transition box to conveyor No. 4. Washing on the rinsing screen is by perforated pipe with Link-Belt spray nozzles.

Conveyor No. 4 is a 24-in. inclined belt conveyor conducting the washed gravel of mixed sizes to the top level of a stacker tower, about 70 ft. above the recovery tunnels. Receiving the material from conveyor No. 4 through a splitter and distribution box are two Ty-Rock F-600 triple-deck screens. Gravel is separated here into four sizes, nominally ¼, ⅜, ¾, and 1½ in. Each size is delivered via chutes and transition boxes to a stacker conveyor. These stacker conveyors, four in number, are 24 in. wide; each is carried on a steel truss and cable suspended and guyed one from each side of the stacker tower. Discharge is about 50 ft. above the roof of the recovery tunnels, and each conveyor is about 65 ft. between centers. Each stockpile of gravel will hold about 7000 tons, 3500 tons of which may be reclaimed without rehandling, through the recovery tunnels.

At this point in the process actual production is complete. Sand and four sizes of gravel are in stockpile and may be recovered and loaded with no further production.

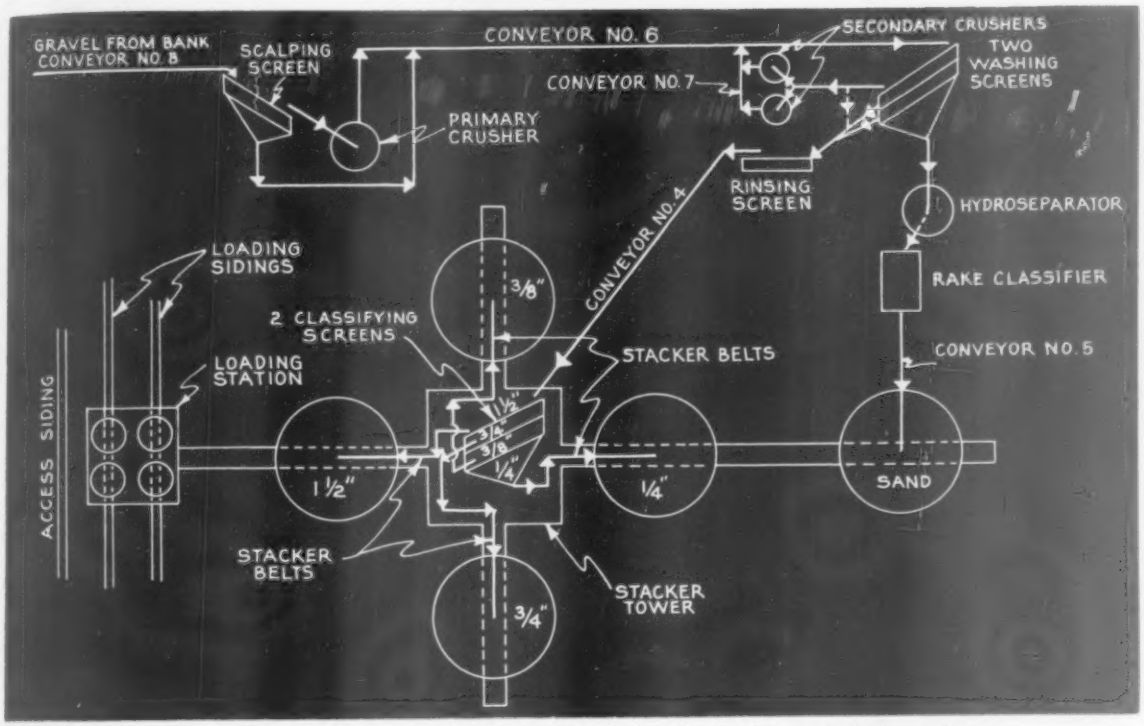
Recovery tunnels, forming a cross in plan, are of reinforced concrete and were precast in 5 ft. long sections. Inside dimensions are approximately 7 x 7 ft.; each section has a male and female joint. Under the tunnel sections is a concrete leveling slab 10 in. thick. Tunnel No. 1 is the main loading tunnel and houses a 36-in. belt conveyor. After leaving the tunnel, No. 1 conveyor ascends a ramp of concrete and structural steel to the loading station. Tunnels No. 2 and 3 are at right angles to tunnel No. 1 and intersect it at the hollow reinforced concrete base of the stacker tower. Tunnel No. 2 and Tunnel No. 3 each has a 30-in. belt conveyor discharging through a hopper to conveyor No. 1. Under each of the four stockpiles of stone and one of sand and in the tunnel roof are three loading hoppers with gates which discharge onto the tunnel belt below. Any size of material or any combination of sizes may be loaded from stockpile through the tunnels.

The loading station at the discharge end of conveyor No. 1 is a reinforced concrete substructure with structural steel superstructure; it is equipped with four circular steel storage bins. Each storage bin has a capacity of about 70 tons. Through the loading station pass two standard gauge railroad sidings, over each of which are two storage bins. At the discharge end of conveyor No. 1 is a rotating chute, by means of which material from this conveyor may be directed to any of the four bins. Each bin is equipped with a gate in the hopper-ed bottom. Loading of cars is done



General view of plant—l. to r. are primary crusher building, secondary crusher building and stacker tower. Loading gallery is at extreme right

UNIVERSITY OF MICHIGAN LIBRARIES



Production flowsheet. Recovery tunnels under the stockpiles feed the four bins at the loading station

through the bins. Generally it is not intended that the bins should be kept loaded. They are merely to carry temporarily any excess from the tunnel belt. However, two bins are equipped with auxiliary chutes to be used for truck loading.

There are three railroad sidings on company property, totaling about 8700 ft. of track. Two loading sidings pass under the loading station and a third, an access siding, by-passes the loading station and joins the other two via a crossover. Thus loaded cars may be removed without any interference with the loading operation. Space is provided for about 60 empty and 50 loaded cars. A General Electric 25-ton diesel-electric locomotive does all the switching.

All wash water for the plant is provided by a Canadian Allis-Chalmers Model SHN 10- x 12-in. centrifugal pump. Capacity is 1800 imperial g.p.m. against a head of 125 ft. Water is carried through a 12-in. welded steel pipe from the pump house to the secondary crusher building, where it is distributed by pipe of varying sizes. All belt conveyors are equipped with anti-friction idlers, both troughing and return idlers; self-aligning idlers are used as necessary. All head, tail, snub and take-up pulleys are mounted on turned and polished shaftings running in ball-bearing pillow blocks. Conveyor equipment is Link-Belt and Stephens-Adamson throughout. Belting supplied by Goodyear, Dunlop and Gutta Percha has all $\frac{3}{16}$-in. cover, $\frac{1}{16}$-in. backing and 32-oz. duck plys. Conveyor drives are all through gear reducers of Link-Belt or Hamilton manufacture. Crusher and screen drives are all by V-belt. Screen cloth throughout has been supplied by W. S. Tyler & Co. of Canada. Motors and controls, all 550 volt, 60 cycle, 3 phase, were made by Bepco Canada Limited. Power is delivered to the company's substation at 26,400 volts where it is stepped down to 550 volts and 110/220 volts. Distribution is by underground cable from the substation to the various process buildings.

Sand is separated from gravel in the secondary crushing building and is processed through this hydroseparator and rake classifier (foreground)

Stepdown transformer is a 750-kv.-a., 3-phase, oil-immersed self-cooling outdoor type.

Control of material to be loaded is accomplished by means of a colored light signal system operated from the control platform of the loading station. All chutes, transition boxes, splitter boxes, etc., are of steel. The practice has been followed throughout of avoiding friction and impact in chutes and boxes, and instead allowing sliding of material.

In the construction of the plant separate contracts were let for stripping, concrete work, steel fabrication and erection, and electrical installation. All other work and installation was done by company employes under company supervision.

A unique feature electrically is that a complete interlocking of controls is installed from the stacker belts down to No. 8 conveyor. Proper sequence of starting must be observed from the stacker belts to the secondary crusher building to the primary crusher building to No. 8 conveyor. However, each control has an alternative manual position to be used for convenience or in case of emergency.

General layout of the plant was developed by officials and employes of the company. R. M. Scrivener of Toronto was consulting engineer, and all detailed designing and equipment specifying was done by him.

Adequate provision has been made for expansion and changes in demand.

(Continued on page 136)

Relation of Ball Load to Clinker Charge in Grinding Mills

Laboratory tests in clinker grinding suggest need for redesign of mills for lower power requirement

By R. A. LOVELAND

LABORATORY BALL tube mill clinker grinding tests* are described. With one exception the data indicate for batch mills, and by inference for continuous mills, that the ratio of ball load to clinker charge should be approximately 15 for maximum power economy when grinding to Type I cement fineness. The ratio of ball load to clinker charge in commercial ball tube mills is considered to be less than 15. The data indicate that redesign of commercial tube mills to obtain a ratio of ball load to mill charge of 15 might result in considerable power savings.

Ratios of ball load to clinker charge greater than 15 are indicated when grinding to Type III cement fineness, and the possible power savings appear to increase with higher fineness.

Applications of findings to commercial closed circuit grinding and ball tube mill design are discussed.

Description of Tests

Equipment. The current grinds* were made in a 21- x 28-in. laboratory batch mill with 500 lb. of steel balls consisting of 190 lb. of ½-in., 200 lb. of ⅝-in. and 110 lb. of ¾-in. balls. The mill was operated between 42.5 r.p.m. and 43.5 r.p.m.

Power consumption. It was the original intention to measure electrically the energy used in grinding. However, variations in voltage, variable friction loads, and changes in motor characteristics with temperature made this impractical. It was thus necessary to assume that with a given ball load the input to the mill was proportional to the number of revolutions. One might suppose that at a given speed the power required to turn the mill would increase as the clinker charge increased. Experience with plant equipment, however, shows that a tube mill containing no feed takes the most power but that the difference in power requirement when the mill contains feed is slight except when the mill is choked with feed. When choking occurs, the power required to operate the mill is much reduced, but, since little grinding is accomplished, the power consumption per unit of production is high.

*The experimental work was carried out at the Portland Cement Association laboratories; all conclusions are the author's.

Preparation of charge. For these grinds approximately 1000 lb. of portland cement clinker was obtained from a manufacturer who reported the following analysis:

SiO_2	21.5 percent
Al_2O_3	6.6
Fe_2O_3	2.9
CaO	65.6
MgO	2.4
MnO	0.43
SO_3	0.42
Loss on ignition	0.00
Total	99.0
Uncombined CaO	1.78

	Calculated compound composition
$3CaO \cdot SiO_2$	53.8 percent
$2CaO \cdot SiO_2$	21.1
$3CaO \cdot Al_2O_3$	12.6
$4CaO \cdot Al_2O_3 \cdot Fe_2O_3$	8.8

The 1000 lb. lot of clinker was reduced by quartering to about 500 lb. This was then crushed in a ring roll crusher using a ⅜-in. screen, and screened through a No. 20 sieve with a vibrating shaker. The oversize was put through a coarsely set disc pulverizer and returned to the screen until all material was minus 20 mesh. The 500-lb. sample was then riffled into eight parts and each part stored separately in sealed 5-gal. cans. The contents of one of these cans was further riffled to obtain 10-lb. samples for test purposes. Mill charges were taken from these 5-gal. cans and further riffled, when parts of a can were used, to avoid segregation.

Measurement of grinding effect. After considerable study it was decided that the Blaine permeability apparatus as described in A.S.T.M. Specification C204-46T was the most suitable device to obtain a measure of the new surface produced in the mill over the range desired for these tests. In the belief that the presence of gypsum would complicate surface determinations, it was not added to the charges.

Since it has been shown† that varying the porosity of the bed formed by the test sample in the Blaine apparatus gives different results for the surface calculated from the instrument readings by the formulas given in A.S.T.M. Specification C204-46T, the porosity was held constant at 0.5 for all the surface determinations.

A laboratory check sample, for which the surface area had been carefully determined by both Blaine and Wagner instruments, was used in calibrating the Blaine instrument. Checks every few days during the test period indicated only slight changes in calibration.

In determining the surface of the minus 20-mesh clinker, 50-g. samples were sieved on the No. 200 sieve and the Blaine surface was determined on the minus 200-mesh portions. The surface of the plus 200-mesh material was calculated by assuming an average particle size for the fractions between the sieves. The combined data gave the surface of the sample as shown in Table I.

Table I. Surface area of clinker charge for grinding tests

Fraction (1)	Percent (2)	Calc. surface area, sq. cm. per g. (3)	(2) x (3) divided by 100 (4)
20-30	15.8	25.0	4
30-50	31.8	38.5	12
50-100	17.2	85.0	15
100-200	10.3	172.0	18
Minus 200	24.9	Blaine surface area=1880	469
Surface area of minus 20-mesh clinker			518

Note: Surface area taken as 520

By this method errors due to the difficulty of obtaining a small representative sample (2.89 g.) of the minus 20-mesh clinker were avoided. Also the desired porosity of 0.5 was suitable for the minus 200-mesh fraction but would not have been for the minus 20-mesh sample.

Grinding procedure. Starting with the mill and ball load free of coating‡, the charge was added, the manhole cover bolted into position, and the mill started. Adjustments of the field rheostat were made at the end of each minute when necessary, to maintain the speed at 43 ± 0.5 r.p.m.

†Blaine, R. L., "Report on Air Permeability Method for Determination of Fineness of Cement," *A.S.T.M. Bulletin*, No. 118, Oct., 1942.

‡Balls and mill were cleaned before each grind but not when the charge was removed for sampling and returned for further grinding.

UNIVERSITY OF MICHIGAN LIBRARIES

At predetermined intervals the mill was stopped and balls separated from the charge with a vibrating screen. The ground clinker was sampled by repeated riffling and, finally, four 1-oz. screw-top bottles were filled and promptly sealed with paraffin. The condition of the balls with regard to coating was noted, the charge and balls were returned to the mill, and grinding continued.

Six runs were made with clinker charges of 125, 80, 50, 30, 15, and 10 lb., respectively. With the 500-ball charge the ratios of ball load to clinker charge were 4, 6.25, 10, 16.7, 33.3 and 50.0 respectively.

Wagner equivalent surface. The surface determinations of previous grinds in this and other laboratories were made with the Wagner apparatus. For the purpose of comparing those experiments with the present series of tests, a factor for converting the Wagner surface to the Blaine surface was determined as follows.

The check sample was reported to have a Blaine surface area of 3300 and a Wagner surface area of 1720, or a ratio of Blaine to Wagner surface of 1.92. However, this sample contains the normal amount of gypsum and none was added to the mill charges for these tests. It may be assumed that the relatively soft gypsum would have been ground very fine and that the Blaine surfaces of the ground clinker would have been considerably higher than shown had the gypsum been added. The Wagner value, on the other hand, would possibly be less affected, as a result of

Table II. Specific surface ratios (Lea-Nurse permeability surface area to Wagner turbidimeter surface area)

Clinker lot no.	Ground with gypsum	Ground without gypsum
1	1.83	1.57
2	1.80	1.61
3	1.78	1.59
4	1.67	1.49
5	1.88	1.62
6	1.78	1.61
Average	1.79	1.58

the assumption of 3¾ microns as the average particle size of the 0-7.5 fraction. Data obtained gives the ratios listed in Table II for grinds with and without gypsum.

From the foregoing results it will be noted that when gypsum was omitted in the grinds the average permeability-turbidimeter surface ratio decreased from 1.79 to 1.58, so that for the grinds without gypsum the ratio is only 0.88 as large as for the grinds with gypsum. In the present test it seems best, since a different type of permeability apparatus was used (i.e., Blaine), to apply the correction to the ratio of Blaine to Wagner surface, namely 1.92, that was found for the laboratory check sample. The result is 0.88 x 1.92 or 1.7 for the ratio of Blaine to Wagner surface for clinker ground without gypsum. Therefore, 3000 Blaine should be approximately equivalent to 3000 ± 1.7, or 1750 Wagner.

Table III. Test results

The coating designation is determined as follows: After the ball is rubbed vigorously between the palms of the hands for a few seconds, the ball is said to be *slightly coated* if 10 to 30 percent of the area is covered; it is said to be *coated* if 30 to 70 percent of the area is covered; and *badly coated* if 70 to 100 percent is covered.

Ratio ball load to clinker charge	Weight of clinker charge, lb.	*Run 1* Mill rev.	*Run 1* Blaine sur. area	*Run 2* Mill rev.	*Run 2* Blaine sur. area	*Run 3* Mill rev.	*Run 3* Blaine sur. area	*Run 4* Mill rev.	*Run 4* Blaine sur. area	*Run 5* Mill rev.	*Run 5* Blaine sur. area	*Run 6* Mill rev.	*Run 6* Blaine sur. area
4	125	2581	1860	4515	2580	7756	3200	Balls slightly coated 11637	3980	Balls coated 18087	4540	Balls badly coated 28407	4680
6.25	80	1291	1905	2581	2820	Balls slightly coated 4591	3450	Balls coated 7744	4110	Balls badly coated 12904	4600	Balls badly coated 18149	4810
10	50	645	1860	Balls slightly coated 1721	3150	Balls coated 3440	4110	Balls badly coated 6450	4615				
16.7	30	213	1950	Balls slightly coated 1397	3590	Balls badly coated 3164	4600						
33.3	15	216	1970	Balls coated 690	3790	Balls badly coated 1592	4950						
50	10	213	2310	Balls coated 641	4260								

Discussion of results. The results of the tests are summarized in Table III, Fig. 1, and Fig. 2*. Ball coating was noted for all the grinds. This coating appeared to be related in some way to the Blaine surface. Probably the surface at which coating became important under these conditions was between 3000 and 4000 Blaine. Additional tests will be required to determine the effect of this coating on the results of this series. In Fig. 1 the curves become steeper as the weight of charge decreases, that is, as the ratio of ball load to mill charge increases. As one would expect, the mill grinds the smaller charges to a given surface with fewer revolutions. Also the slope of each curve is decreasing as the surface increases. Note from the *dashed lines* that the ratio of the increase in surface to the number of revolutions corresponding to this increase is the average slope of the curve at the interval of surface considered. If we assume that the power per revolution is constant, the slope of the curves represents the production of surface per unit of power at a given surface.

Referring again to the dashed lines in Fig. 1, it is seen that in the grinding range, 2500 to 3000 Blaine, the mill produces twice as much surface at a ratio of 6.25 as it does at a ratio of 4.0, for the same number of revolutions. Furthermore, since the charge for the 6.25 ratio (80 lb.) is ⅔ of the charge (125 lb.) at ratio

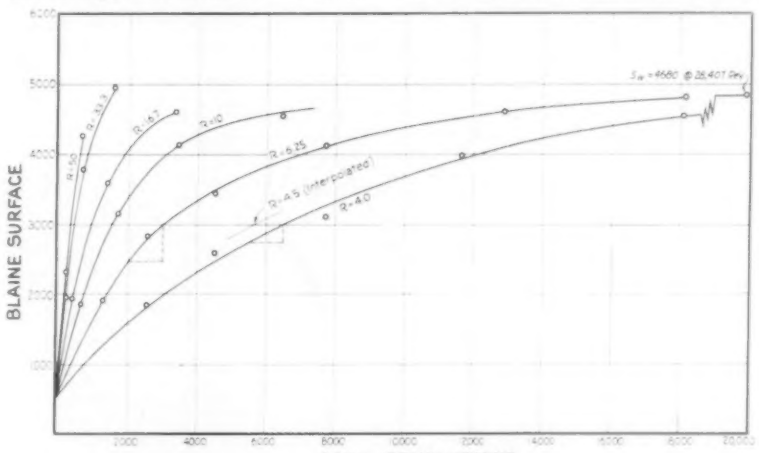


Fig. 1: Blaine surface area as a function of mill revolutions (21- x 28-in. laboratory mill, 500 lb. of balls; R = ball load to clinker charge ratios. Feed fineness, 520 Blaine surface)

*In Fig. 2 the mill revolutions are shown to big scale so as to indicate more accurately the relationships with large ratios of ball load to mill charge.

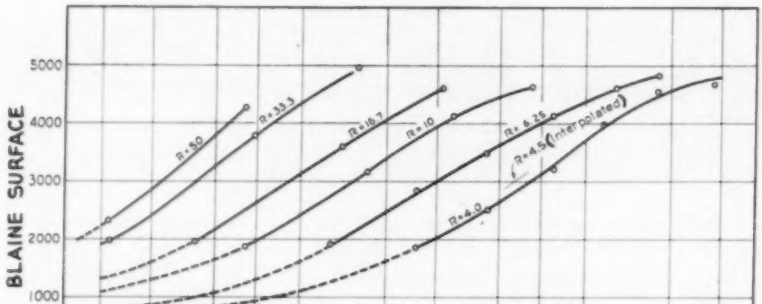


Fig. 2: Mill revolutions as a function of Blaine surface (21- x 28-in. laboratory mill, 500 lb. of balls; R=ball load to clinker charge ratios. Feed fineness, 520 Blaine surface)

4.0, an increase in efficiency (total surface produced per revolution) of approximately 30 percent is indicated.

To evaluate these differences in efficiency the number of revolutions for the various clinker charges for surfaces of 2000, 3000 and 4000 Blaine surfaces were taken from Fig. 1 and are shown respectively in Tables IV, V, and VI together with the weights of the charges, the pounds of ground clinker produced per 1000 revolutions, and the relative production. In computing the relative production values, the number of pounds per 1000 revolutions at ratio of ball load to clinker charge of 6.25 was taken as 100.

From the data in Table IV, V and VI, Fig. 3 was obtained. The curves in Fig. 3 show a rapid increase in output per 1000 mill revolutions as the ratio of ball load to clinker charge increases. Under the conditions of these tests it is indicated that when grinding to 2000 Blaine surface, maximum production is obtained with ratios of ball load to clinker charge of approximately 15. In grinding to 3000 Blaine surface, maximum production is apparently obtained at a ratio of ball load to clinker charge of about 20. For 4000 Blaine surface, the curve shows highest production at a ratio of ball load to clinker charge of about 30.

Example. Consider the job of grinding 1200 lb. of clinker to 3000 Blaine surface. This could be done in 15 batches of 80 lb. each using a ratio of ball load to mill charge of 6.25.

Each batch would require 3050 revolutions, or a total of 45,750 revolutions for the 15 batches (see Table V). The mill turns 43 revolutions per minute or 2580 revolutions per hour, and the running time would be 17.7 hr.

This could also be done in 80 batches, grinding 15 lb. per batch, using a ratio of ball load to mill charge of 33.3. Each batch would require 440 revolutions, or a total of 35,200 revolutions for the 80 batches, and the running time required would be 13.6 hr. This is a saving of 4.1 hr. Thus to grind 1200 lb. in 80-lb. batches would require 30 percent more grinding time than in 15-lb. batches.

Commercial mills. Referring again to the curves in Fig. 1 and then to a diagram (Fig. 4) from Meade's book on portland cement* showing the gain in fineness in a tube mill sampled at 4 ft. intervals, we note a striking similarity between Fig. 4 and the curves representing the lower ratios of ball load to clinker charge of the present tests.

We might expect that if we could increase the ratio of ball load to mill charge by using a mill of different design, the results of a similar sampling would yield curves similar to those of higher ratios, and the gains indicated for batch mills might also appear in commercial continuous mills.

In commercial mills the ratio of ball load to mill charge is determined by such factors as the dimensions and grate area of the mill, the fluidity of the mill feed and partly ground clinker, and the feed rate.

The feed rate in open circuit grinding is of necessity adjusted to obtain the required fineness of product; hence, the ratio of ball load to mill charge is, in general, not known and is not under the control of the operator.

In closed circuit grinding the rejects from the air separator are returned to the mill along with the new feed. The effect of this in general is to reduce the ratio of ball load to mill charge.

The following is an attempt to predict the possible effect of control of the ratio of ball load to clinker charge on grinding efficiency. It has been the observation that, in general, commercial clinker grinding mills are operated with a clinker quantity sufficient to fill the voids within the charge. Such has been the condition of many mills observed in which the feed and mill power were shut off simultaneously. It is believed that where a free flow of material through the mill is permitted and the feed rate is adequate, the media charge holds enough clinker to approximately fill the voids between the media.

On this basis, if the cement weighs 94 lb. per cu. ft. and the steel balls 281 lb. per cu. ft. with 43 percent voids, the ratio of ball load to mill charge is approximately 7:1.

If the relations indicated here for the laboratory mill were directly applicable to the typical commercial mill indicated by the foregoing, it would be expected that redesign of the commercial mill to increase the ratio of ball load to clinker charge to the optimum values indicated in Fig. 3 should result in the gains in efficiency shown in Table VII.

It is seen that increasing the ratio of ball load to clinker charge is more effective for increasing production when grinding to the higher surfaces.

Table IV. Grinding accomplished at 2000 Blaine

Ratio, ball load to clinker charge	50	33.3	16.7	10	6.25	4.0
Charge, lb.	10	15.0	30.0	50	80.0	125.0
Rev.	170	223	445	735	1400	3050
Lb. per 1000 rev.	58.9	67.3	67.5	68	57.1	41
Relative production	103	118	118	119	100	71.8

Table V. Grinding accomplished at 3000 Blaine (=1750 Wagner approximately)

Ratio, ball load to clinker charge	50	33.3	16.7	10	6.25	4.0
Charge, lb.	10	15	30	50	80	125.0
Rev.	332	440	910	1550	3050	6500
Lb. per 1000 rev.	30.1	34.1	33.0	32.2	26.2	19.2
Relative production	115	130	126	123	100	73.4

Table VI. Grinding accomplished at 4000 Blaine

Ratio, ball load to clinker charge	50	33.3	16.7	10	6.25	4.0
Charge, lb.	10	15	30	50	80	125.0
Rev.	563	805	1870	3150	7050	12,200
Lb. per 1000 rev.	17.8	18.6	16.0	15.9	11.3	10.3
Relative production	158	165	142	141	100	91.1

Applications

Relation to grinding aids. The data suggest an explanation of the action of grinding aids. These substances facilitate the passage of the material through the mill, thus increasing the effective ratio of the ball load to mill charge, which could result either in higher fineness or more production from a given unit.

Closed circuit grinding. It is possible to show from these data why closed

*Meade, R. K., "Portland Cement," 3rd edition, page 208.

UNIVERSITY OF MICHIGAN LIBRARIES

circuit grinding can be advantageous and also to explain why expected economies do not always result from its use.

The following analysis of data from Table VI shows the amount of new surface* produced for 1000 revolutions of the mill when grinding to Blaine surfaces of 4000 and 2000.

Blaine surface	Surface-pounds per 1000 revolutions
4000	15.9 (4000−520†)= 55,300
2000	68 (2000−520†)=100,500

†520 is Blaine surface of clinker feed

Assuming that the particles of crushed clinker are of approximately uniform grindability, this analysis indicates that a very large saving in power could be expected from grinding a coarse product, separating out a fine product, and further grinding the oversize. The lack of satisfactory gain in efficiency when long slender mills are used may be due to the reduced ratio of ball load to clinker charge caused by the return of the oversize.

Clinker grinding mill design. The ratio of ball load to mill charge in a continuous grinding ball mill is affected by the following factors:

Dimensions of mill

Grate area

Shape, grading, and surface characteristics of ball charge

Fluidity of feed and partly ground product

Feed rate

A relatively large grate can easily be obtained in a mill, the diameter of which is large compared with its length; hence, the ratio of ball load to mill charge could be much higher than in the conventional long, slender tube mill. It is interesting to note that J. M. Wolfe† points out a trend toward shorter mills of larger diameter supplanting the conventional long, slender tube mill for the cement plant of the future.

*Values reported (surface-pounds) are Blaine surface difference times weight of charge in pounds.

†Wolfe, J. M., "What Is the Future of Grinding?", Rock Products, January, 1947, page 119.

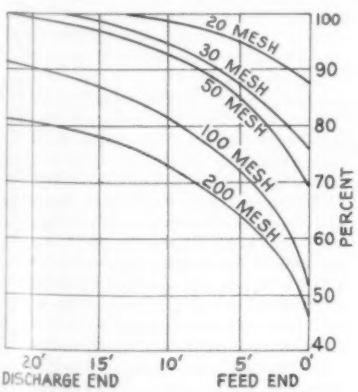


Fig. 4: **Cement fineness determinations in a 5-ft. tube mill**

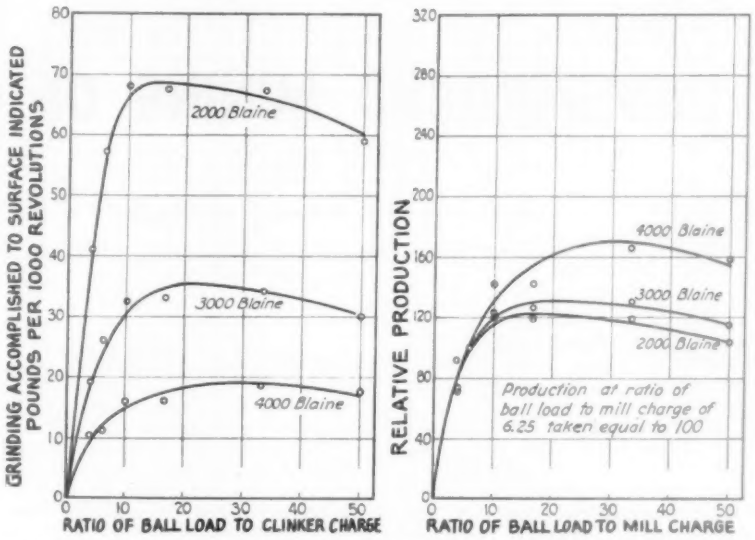

GRINDING ACCOMPLISHED TO SURFACE INDICATED POUNDS PER 1000 REVOLUTIONS
2000 Blaine
3000 Blaine
4000 Blaine
RATIO OF BALL LOAD TO CLINKER CHARGE
RELATIVE PRODUCTION
4000 Blaine
3000 Blaine
2000 Blaine
Production at ratio of ball load to mill charge of 6.25 taken equal to 100
RATIO OF BALL LOAD TO MILL CHARGE

Fig. 3: **Grinding accomplished, pounds per 1000 revolutions, and relative production versus ratio of ball load to clinker charge**

Table VII. Gains in efficiency through design

Blaine surface	Production, lb. per 1000 rev.		Increase in production	
	At ratio ball load to clinker charge=7	At optimum ratio ball load to clinker charge	lb. per 1000 rev.	percent
2000	59	69	10	17
3000	25.5	35.5	10	39
4000	13	19	6	46

Mineral Wool

The Industrial Mineral Wool Institute recently issued a series of pamphlets on the various uses of mineral wool, exemplifying the versatility of this product. Following is a summary of some specialized uses described in the pamphlets.

One use is as an insulation for turbines which require a material that can be easily applied to irregular, hard-to-get-at surfaces. Since temperatures in different zones of a turbine vary considerably, it is most economical to use an insulator whose thickness can be conveniently changed according to temperature. For this, a mineral wool cement is recommended.

Another use is as an oil-tank jacket. Lubricating oil blending stocks are difficult to unload when at low temperatures and high viscosity. Mineral wool boards on the barge tanks supply adequate insulation for keeping the oil warm from starting point to destination.

Other applications include: mineral wool blankets for insulating outdoor storage tanks; mineral wool felt for insulating floors, walls and ceilings; mineral wool insulating blocks for heated sheet-metal ducts used in power generation and distribution; mineral wool removable jackets for insulating the evaporator sections of vapor-compression distillation units; as a pipe insulator, of which there are three types—blanket type, molded type or insulating cement; and as an insulating material for maintaining hot liquid materials at proper storage temperatures.

These pamphlets are available through the Industrial Mineral Wool Institute, 441 Lexington Ave., New York 17, N.Y.

Phosphate Expansion Goals Set

Defense Production Administration has set up expansion goals which call for sharply increased production of phosphate rock, phosphatic fertilizers and phosphatic feed supplements by July 1, 1954.

The goal for phosphate rock calls for capacity to produce 5,000,000 long tons annually by July, 1954, which is an increase of 1,500,000 tons over 1951 production.

The D.P.A. goal for fertilizers for domestic use and for export has been set at 3,600,000 tons annually, which includes superphosphate, ammonium phosphate and similar types of fertilizers. D.P.A. stated that this goal would increase annual domestic production of phosphatic fertilizers by 1,400,000 tons, compared with the output of 1951.

The goal for phosphatic feed supplements has been set at 285,000 tons annually, which would mean an increase of approximately 125,000 tons over 1951 output.

UNDERGROUND MINING OF CEMENT ROCK

Coplay Cement Manufacturing Co.'s mine being developed using tungsten carbide bits and millisecond delay blasting

By A. F. RAMBOSEK*

THE FIRST PORTLAND cement was produced at Coplay, Penn., by David O. Saylor in 1871. The basic raw material used at that time was an argillaceous limestone, locally known as "cement rock." For many years this cement rock was used either by itself or with small amounts of locally quarried limestone. As time went on, however, the specifications for portland cement were raised and became more rigid. These conditions, coupled with the depletion of the better grades of cement rock, brought about the need for producing large quantities of limestone to be blended with the cement rock. Under the direction of D. J. Uhle, vice-president of Coplay Cement Manufacturing Co., prospecting for limestone was started in 1925. Most of the prospecting was done with churn drills, with a small amount of supplementary diamond drilling.

This drilling program revealed the presence of a large limestone deposit on the south edge of the company's No. 3 quarry. In 1927 quarrying of this limestone was started and in a short while the limestone requirements of the company were met. In 1945, however, it became apparent that further prospecting was necessary as quarrying operations had made contact with what was thought to be the basal dolomite of the area. In 1949 the company decided to prospect for additional limestone by underground mining methods and the first headings were started from the bottom level of the limestone quarry.

In April, 1950, the mining operations and all exploration were placed under the supervision of R. W. Jenkins, who at that time was assistant manager of the company, and it was largely through his efforts that the mining and prospecting procedures were developed.

Geology

Considerable material has been written about the sedimentary geology of this area, but previous investigations had not been made in sufficient detail to provide the type of information needed by a mine operator. According to earlier concepts, the cement rock, of Ordovician age, comprised the upper facies of the Jacksonberg formation, and was underlaid by a lower facies which consisted of a crystalline limestone. This in turn was underlaid by a basal dolomite which is known as the Beekmantown formation.

It was found, however, that instead of one limestone bed, the formation consisted of three separate limestone horizons separated by two relatively thin beds of dolomite. The lower limestone bed is in contact with what is believed to be the Beekmantown dolomite. The limited amount of prospecting which has been done in this dolomite has revealed no limestone of any economic significance.

The area has been subjected to considerable folding and faulting which resulted in a large amount of fracturing of the rock. This was followed by the introduction of quartz and some calcite in the fractures, with particularly high concentrations of quartz in some portions of the cement rock. To a large extent, it is the amount of this quartz which determines the grade of the cement rock.

The structure in the limestone area was found to be a recumbent fold with a slightly dipping axis. All development work to date has been on portions of the fold beneath the axis, and in general where the dip of the beds is very steep.

Mining Procedure

The first headings, started in December, 1949, from the lowest level of the limestone quarry area, were drilled with a truck-mounted jumbo with a 6-ft. chain feed. Broken rock was loaded with a front-end loader into 5-cu. yd. dump trucks. Later the company bought a Joy 16 HR loader which has been used ever since. The trucks, which were later replaced by a Joy 60E12 shuttle car, dumped into 7-ton skips which were available from the limestone quarrying operation. The skips discharged directly into the quarry crusher, where the limestone was blended with the cement rock.

It was necessary to train miners for the work, since under the terms of the union contract the company was forced to post the jobs as available and men were selected solely on the basis of seniority.

The original heading size was approximately 24 ft. in width by 12 ft. high. A V-cut with 12-ft. holes was tried but did not prove to be particularly successful. This was largely due to the inability of inexperienced men to place long holes properly.

The length of the round was then shortened to 10-ft. cut holes and 7-ft. side holes. Careful supervision of the work helped develop the ability of the men and they were soon able to place their holes with a fair degree of accuracy. The rounds were then changed to 12-ft. holes in the V and 9-ft. side holes and the chain feeds on the jumbos were lengthened to 9 ft. As the headings were being driven in steeply dipping portions of the limestone beds, and since the intense folding had given the rock a fractured nature, there was no natural parting to provide a smooth back for the headings. It was, therefore, decided that flat back holes would be used in all rounds and the upper cut holes would bottom a sufficient distance below the top of the heading to prevent undue shattering of the back. This procedure has materially decreased the amount of scaling necessary.

All rounds were standardized as to the number and angle of cut holes, the number of holes in each row of side holes, and timing of rounds. The only variation permitted was in the number of rows of side holes. This was varied in accordance with the width of headings.

A standard heading width of approximately 24 ft. was soon found to give the optimum results. This is the minimum width in which the 12-ft. cut holes can be properly placed, and any substantial increase results in considerable "bootleg" in the holes near the walls.

The first heading rounds were blasted with 60 percent powder and standard electric blasting caps. This powder was found to be too fast and present practice is to use three sticks of gelatin in the bottom of each hole, followed by 40 percent Atlas Gelodyn. Millisecond delays are now being used in all the underground work. Sub-

*Chief engineer, Coplay Cement Manufacturing Co., Coplay, Penn.

UNIVERSITY OF MICHIGAN LIBRARIES

stantial improvements in blasting efficiency have resulted from these changes.

At present there are three two-man driller-blaster crews. It has been found that for maximum efficiency, a minimum of four headings per crew is necesary. Drilling is scheduled in such a manner that a crew can drill out two or more adjacent faces from one set-up.

A crew requires two days to drill and blast a round, whereas three days are required to drill and blast two rounds from one hook-up. It is readily seen that proper scheduling of the drilling will result in greatly increased output from the drill crews.

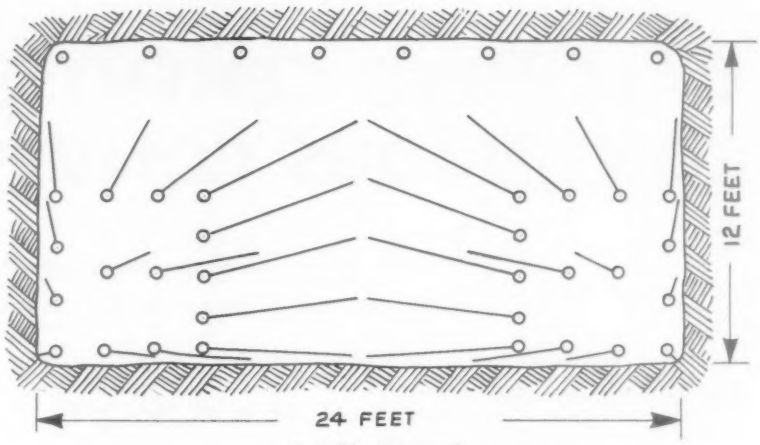
When the mine was first opened, standard detachable bits were used in all drilling with a 2-in. dia. starter bit. Later several types of one-pass bits were tried, but a 1⅝-in. dia. tungsten carbide bit and alloy drill steel was finally adopted. The smaller bit diameter resulted in an increased drilling speed and lower powder consumption. In spite of this, the bits were not considered entirely suitable, as the drill steel often broke in the threads and many bits were lost in the hole. The company then changed to an alloy drill steel with the carbide inserts set in the end of the rod. This has proved to be the most suitable and is still in use today.

Provisions were made for grinding the inserts when dull, but it was soon learned that carbide loss was high on reground bits, as there was considerable tendency for the inserts to pull out. It was then learned that this trouble could be largely avoided by grinding the bits with a $\frac{1}{16}$-in. face on the cutting edge.

The loading crew consists of two men on the loader and two scalers. The bulk of the scaling is done from the muck pile; the operator is always under freshly scaled ground. In the final phases of loading out the rock, the scalers trim down the walls and face as they become exposed, and the heading when cleaned is completely readied for drilling.

It would be well to note here that all underground workers have been trained in scaling and in spite of the care used by the loader crew, all drillers are instructed to inspect the heading carefully for loose ground before setting up the jumbo. This emphasis on scaling was necessitated by two previously mentioned factors: (1) the lack of experienced miners, and (2) the fractured nature of the ground.

All broken rock is hauled with the Joy 60E12 shuttle car which was mentioned earlier. This unit averages 14 tons per trip over grades as steep as 15 percent. Exhaust gases are treated with a chemical-type scrubber which uses a solution of sodium sulfite and hydroquinone as scrubbing agent. Weekly tests for carbon monoxide with a squeeze-type detector have shown that concentrations of the gas are always less than 0.0005 percent. The scrubbing solution is made up daily with 10 lb. of sodium sulfite and 0.5 lb. of hydroquinone in 15 gal. of water. A makeup tank containing 45 gal. of fresh water automatically maintains the solution level as the water evaporates from the scrubbing tank.



Typical heading round

The tight folding and resultant fracturing have completely obliterated bedding planes in the rock. Consequently, it is very difficult, if not impossible, to separate the limestone visually from the dolomite. Headings are necessarily controlled by assay, with samples taken at each side of the face after every round. Assays are posted on 20 scale assay-plan maps. The use of these maps has made it possible to anticipate changes in strike and to keep the headings in limestone. The dolomite is left in pillars with occasional cross-cuts through the dolomite to provide access and improved ventilation.

Shortly after the first headings were opened, the company started additional prospecting from the surface with a diamond core drill. The information thus gained, when added to that from the underground work, made it possible to lay out work in a systematic manner. Thus far, the headings have been driven primarily for the purpose of prospecting and development, but it has always been necessary to bear in mind the ultimate goal of setting up a stoping system.

The limestone will be stoped by a diamond drill blast-hole method, using the present loading and hauling equipment for the removal of broken stone. All current and future development work is laid out with this thought in mind. The headings now being driven are for the purpose of stope preparation.

At the present time the mine is producing 300 t.p.d. with 11 underground workmen. Powder consumption is approximately 0.95 lb. per ton of broken stone.

In conclusion, the writer wishes to thank D. J. Uhle, vice-president, for permission to publish this paper, and to acknowledge the assistance of L. M. Yarberry, mine superintendent, and William A. Jones, plant superintendent, for their assistance in its preparation.

Phosphate Plant

DAVISON CHEMICAL CORP. has started construction of a plant at Ridgewood, Fla., between Bartow and Mulberry, for the production of triple superphosphate. The new plant, which is expected to be completed by October, 1953, will employ approximately 250 people. The project is part of the company's $25,400,000 expansion program.

National Gypsum Progress

NATIONAL GYPSUM CO., Buffalo, N.Y., may possibly have a sales volume of more than $100,000,000 this year. Last year, the company's sales set a new peak of $95,500,000. Although the demand for the company's products is holding at the 1951 level, there has been a softening of the market reflected in small drops in order backlogs at most of the company's plants.

Gravel Plant Opening

FENTON CONSTRUCTION CO., Troy, Ohio, was host to more than 100 guests at the opening of its new gravel plant. Representatives of the state highway department attended from Columbus, Sidney and Middletown, and numerous county and city officials were present from Troy, Piqua and Springfield. Contractors, material producers, engineers and equipment manufacturers from points in Ohio and adjoining states also attended.

CALCINING CEMENT SLURRY ON CONTINUOUS CONVEYOR GRATE

Review of technical developments in the design and use of sinter-grate kilns in Europe

By B. M. PEARSON*

CONSIDERABLE ATTENTION and development work is being devoted in Europe to the question of burning cement on the Dwight-Lloyd type continuous conveyor band furnace (in Europe this unit is manufactured by the German Lurgi Gesellschaft concern). Operational facts and details in connection with burning cement on this type of kiln at the Stadt Oppeln cement plant have been given by K. Boerner and R. Kirste.[3] A previous article by H. Wendeborn[4] has dealt with design and installation considerations and the planning of modern cement plants with sinter-grate kilns.

Lurgi Conveyor Band Sinter Grate

A representative unit of the Lurgi conveyor band sinter grate for cement burning is shown in Fig. 1. This unit, installed in a German cement plant, is 40 ft. long, 6 ft. 6 in. wide and operates at a speed of about 2 f.p.m. and has an output of about 350 t.p.d. The drawing shows the normal arrangement of the sinter band grate kiln arranged to work on the dry mix process. The fuel is coke, which is mixed with the dry raw material. The mixture is ground and then fed by gravity along with a small proportion of clinker onto the moving grate. A pulverized coal flame is directed upon a length of about 6 ft. of the grate and the material is subjected to a temperature of 1300 deg. C. to 1400 deg. C. for about 3 min. The gases are drawn through the grate and the material on it discharged to the atmosphere. At the discharge end of the grate band, the burned material passes through a crusher and then is carried to the clinker storage.

Details of the layout shown in Fig. 1 are as follows. The bins (1, 2 and 3) contain, respectively, crushed coke from about ¼ in. down, crushed raw material, and crushed clinker (0.3 in. down) and insufficiently burned material. The raw material comprises 60 to 70 percent limestone with the remainder schist. The fuel and raw material are weighed (4), mixed in the mixing screws (5) and passed to the nodulizers (6) where 12 to 15 percent water is added. The composition of the mixture is now about 100 parts of raw material, 65 parts clinker (0.3 in. down), 11 parts coke and 12 parts water. The mixture passes to the calibrators (7) and then to the hopper (8) which feeds the grate (10).

The clinker is brought along the conveyor (15) to the classifying screens (16) from which material less than 0.3 in. is discharged into bin (3) and material from 0.3 in. to 0.5 in. is fed directly to the grate through the hopper (9). Pulverized coal is stored in a hopper (20) and is propelled by a fan (19) to the ignition chamber (11).

The grate (10) has a usable surface of about 270 sq. ft. Each link is about 6 ft. 6 in. long and 3 ft. 3 in. wide and comprises three ranges of 0.4 in. dia. bars, 10 to 12 in. wide. The method of fixing the bars permits replacements to be made easily while the grate is moving. About 50 bars are changed daily. The gap between the bars is about ¼ in. The bed of clinker (0.3 to 0.5 in.) used as refractory has a thickness of 2½ to 4 in. The nodulized material from (8) forms a bed 12 to 16 in. thick.

The bed of material passes under the ignition chamber (11) which covers a length of about 6 ft. 6 in. of the grate and is subjected to a temperature of 1300 to 1400 deg. C. for a period of 3-3½ min. The grate then passes over eight windboxes in which the temperature of the gases varies as shown. The material on the grate is clinkered in the process. The wind-

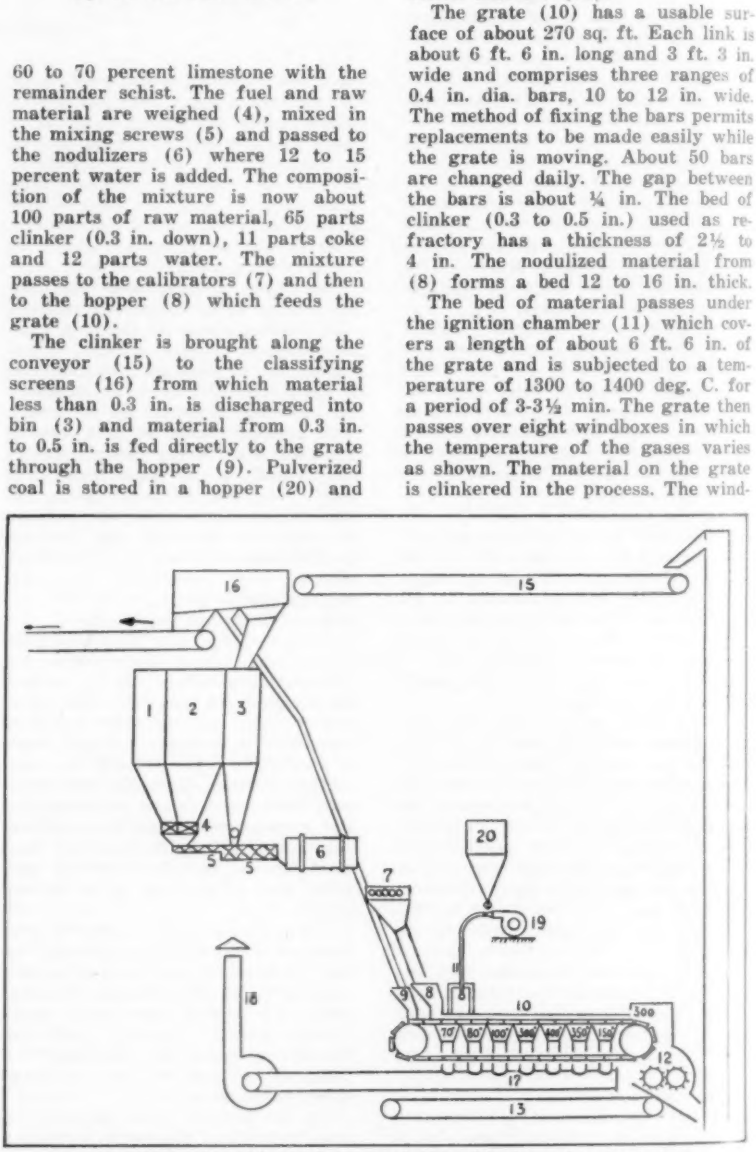


Fig. 1: Lurgi sinter band kiln unit for cement burning. (Numbers referred to in text)

Review of work by K. Meyer and H. Wendeborn, *Zement-Kalk-Gips*, Vol. 4, No. 1, page 4-7.

*Consulting engineer, Saxonhurst, North Bank, Hassocks, Sussex, England.

UNIVERSITY OF MICHIGAN LIBRARIES

boxes are connected to a main flue (17) which leads to a stack (18). When the grate reaches the end of its travel, the material is discharged into a crusher (12) and removed by a conveyor (13).

The power required to operate the unit is about 90 kw.-hr. per ton of cement. The thermal balance for the production of 250 tons of cement, using coke having a heating value of 5200 calories per ton, is:

	Calories		Calories
Coke	990	Burning	407
Firing	116	Drying	262
From the schist	100	Carried away by flue gases	413
	1206	Carried away by clinker	62
		Radiation	62
			1206

While the potentialities of the sinter band grate process for clinkering cement are fairly well known to the cement industry, many are somewhat surprised and find it difficult to understand without further details that it is also possible to process cement slurry of normal consistency and produce a good clinker on this sinter band kiln unit. Actually, slurry burning has been practiced on the sinter band kiln for a fairly long time, since 1935 to be exact, when the first developments in this direction were commenced.[5,6,7]

Slurry Burning on the Sinter Band Furnace

Up to the present time, cement slurry has been burned exclusively in the rotary kiln. Cement firing systems which are otherwise characterized by such good thermal efficiency, such as the shaft kiln or the Lepol kiln, cannot be used for processing slurry because the viscosity of that material will permit neither briquetting nor nodulizing, both of which are required for the kiln feed. In spite of a number of advantages the higher fuel consumption when sintering slurry in these kilns becomes a serious technical disadvantage.[1] In Table I are given comparative fuel consumption figures in terms of k.cal./kg. of clinker with various individual dry and wet process kiln systems.

The most favorable thermal efficiency values are attained with the Lepol kiln, the shaft kiln and the sinter band process. The last unit, which from the thermal efficiency point of view is at about the same stage as the shaft kiln, has however the great advantage over the Lepol and the shaft kilns in that it embodies the possibility of slurry sintering and accordingly combines the most favorable thermal efficiency figure with the known advantages of the slurry process system.

The specific outputs in terms of clinker/cu. m. of furnace volume are also different for the wet and the dry processes. Wet process rotary kilns work with lower outputs, if one excludes the exception of the rotary kiln operating with slurry spray injection.

Process Features

The conveyor band type cement sintering kiln accordingly assumes a special position in cement sintering technology. Some characteristic features of the cement sintering process on this unit may be given as follows:

1. Complete combustion of the solid fuel in direct contact with the raw material.
2. Preheating of the reaction components by direct heat transfer by means of hot waste gases.
3. Attainment of the maximum reaction temperatures in the shortest time and rapid cooling after the formation of clinker.
4. The use of feed-back material for control of the thermodynamic reactions.

While the conveyor grate unit has the first characteristic (above) in common with the shaft kiln, which is the mixing of the raw material with the solid fuel, and the second characteristic in common with the Lepol kiln and the shaft kiln, comprising the preheating of the reaction products by the hot waste gases, the third and fourth characteristics are peculiar to the cement sinter band grate process, as will be seen from the following.

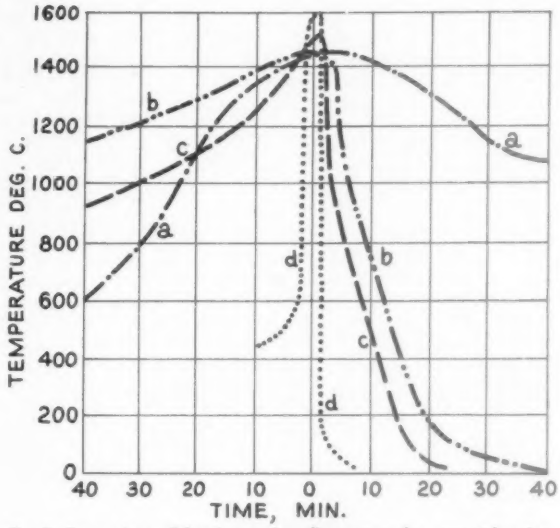


Fig. 2: Comparison of heating and cooling curves for cement burning by various burning systems:

System	Sinter temp., max., deg. C.	Burning velocity, cm./min.
(a) Lepol kiln	1450	—
(b) Shaft kiln	1470	2.66
(c) A-shaft kiln	1470	2.66
(d) Sinter band grate kiln	1550	2.74

Burning time from 1200 deg. C. to:

1450 deg. C. with Lepol kiln	28.5 min.
1470 deg. C. with shaft kiln	3.5 min.
1470 deg. C. with A-shaft kiln	1.0 min.
1550 deg. C. with sinter band kiln	51 sec.

Heating and cooling times for various processes in min.

Heating from	Sinter band	Lepol kiln	Shaft kiln	A-shaft kiln
20 to 500 deg. C.	6.0	18.0	25	15
500 to 850 deg. C.	0.5			
500 to 900 deg. C.		17	3	5
850 to 1550 deg. C.	1.0			
900 to 1450 deg. C.		82	10	5
Cooling from				
1550 to 1000 deg. C.	0.8			
1450 to 1000 deg. C.		28	56	30
1000 to 500 deg. C.	5.0	13	92	92

In Fig. 2 is given a comparison of the heating and cooling curves[2] for cement burning by means of various burning systems. The curve corresponding to the sinter band grate process is quite different from all the other systems. In the shortest period of time the highest temperatures are attained (combined with increased diffusion capacity) and in the same period of time the clinker formed is cooled to a temperature range in which no harmful recrystallization is possible.

Utilization of Returned Material

The returned (feed-back) material which it utilizes differently from other cement burning processes hardly influences the total over-all fuel consumption, as can be seen from

Table I. Thermal consumption in thermal units/kg. clinker

Process	Kiln system	Thermal units/kg. clinker including subsequent recovery
Dry	Lepol kiln	985
Dry	Shaft kiln	1100
Dry	Lurgi sinter band grate	1100-1250
Dry	Rotary kiln with preheater	1250
Dry	Rotary kiln—normal	1550
Wet	Rotary kiln with preheater	1350
Wet	Rotary kiln with chains—long	1450
Wet	Rotary kiln with chains—short	1500
Wet	Rotary kiln—normal	2100
Dry	Rotary kiln with waste heat recovery	1750-550=1200
Wet	Rotary kiln with waste heat recovery	2100-430=1670

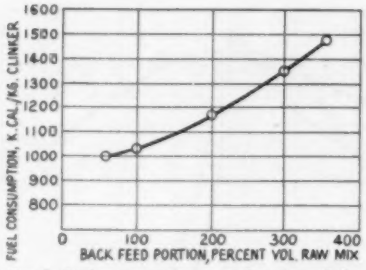


Fig. 3: Fuel consumption as a function of the back feed portion in the sinter portion

Fig. 3 which shows the relation of the fuel consumption as the returned material proportion in the sinter mixture. If the fuel consumption is evaluated at 100 (Fig. 4) with an addition of 100 percent returned material, then the fuel consumption up to a feed-back material proportion of 300 percent is only increased by about 35 percent of the original value.

This fact makes it possible to dry out the raw cement slurry with the addition of so much returned material, until the mixture has the required moisture content for the sintering. The optimum water content of the granules for sintering amounts to about 12-14 percent calculated on the total dry substance (raw mix, returned material, fuel).

With the sintering of the raw mix, the addition of the feed-back material provides a strategic aid. It is obtained by sieving out the slightly burned as well as the fine grained sinter below 6 mm. from the well sintered mass. As soon as raw slurry is processed, however, the returned material acts as a drying agent, in addition to the functions mentioned. Special value is accordingly placed on good suction possibilities, which can be installed under certain conditions.

It has been mentioned previously that the waste gas from the last third of the sinter grate reaches temperatures up to 350 deg. C. If it is possible to use this heat to any considerable extent, then there results a thermal increase of about 150 k.cal./kg. of clinker.

This heat can be used for the evaporation of part of the water contained in the raw slurry, complete removal of which is principally responsible for the higher heat consumption compared with the processing of raw mix.

For drying a part of the raw slurry with the waste gases, various technical possibilities are presented. For example, the hot gases can be drawn off by a special exhaust fan and brought into contact with the slurry in separate drying equipment. The raw mix which is formed in this way can then be mixed with the chief part of the slurry, with the fuel and with the returned, feed-back material.

It is also possible, however, to utilize the waste heat directly on the grate. This is accomplished by passing the waste gas through a sub-layer of fuel-free nodulized material which is placed directly on the grate and which is prepared from slurry and returned material. The water

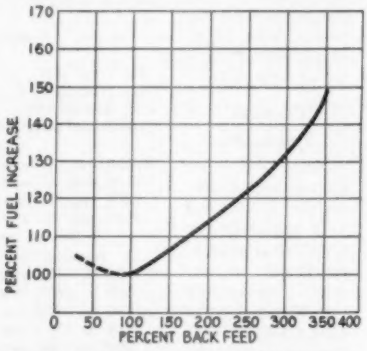


Fig. 4: Percentage increase of fuel consumption in relation to back feed proportion

evaporates and a part of the $CaCO_3$ is decomposed. This layer does not reach the sintering point, however, and on sieving out it subsequently passes into the classified portion, which during the course of the process becomes mixed with the slurry.

The working stages of this process can be followed by means of the diagram given in Fig. 5. As is customary, the grate (1) is first charged with a 3 cm. thick loading of finished sinter of particle size 8-25 mm. On this there is laid, according to requirements, the fuel-free sub-layer (2) consisting of cement raw slurry and returned material. Over this is placed the normal sinter loading (3) which contains the necessary solid fuel for the sintering process. Beneath the ignition hood (4) the fuel is ignited, and the vacuum induced in the windbox (5) by a draft fan serves to maintain the combustion. On being discharged, the whole grate loading passes through toothed rollers (6) and is separated on a vibrating screen (7) into sizes of minus 8 mm., plus 8 mm. minus 25 mm. and plus 25 mm. The grain size below 8 mm. contains, in addition to the fine grained material, the incompletely burned sinter and also the dried raw slurry. This mixture circulates in the system. The grain size of 8-25 mm. provides, as far as is necessary, the grate loading and any left over from this use passes with the oversize (plus 25 mm.) to the clinker grinder.

The most favorable working conditions were ascertained in various tests of individual slurries in which it was found that the simple sintering of slurry with the addition of return material and without waste heat recovery is best.

With a thermal consumption of about 1630 k.cal./kg. of clinker, a slurry with about 38 percent water and with return material in the ratio of 1:1.35, as well as additions of fine coke and fuel, will give an output of 8 tons of clinker per square meter of grate area. The waste gas temperature reached a maximum of about 350 deg. C.

For a further series of tests, some of the available waste gas was utilized to convert a corresponding amount of raw slurry into dry raw mix. This was then granulated with raw slurry, return material and fuel. The return material portion was reduced to 1.25:1. With this method of working, however, the fuel content could be reduced from 1630 down to 1420 k.cal., i.e., a reduction of around 29 percent.

With the third series of tests, separate drawing off of the hot waste gases was avoided and the band-grate kiln was worked with a fuel-free sub-layer which contained as much slurry as corresponded to about 20 percent of the total slurry being processed. The thermal consumption here again amounted to only 1420 k.cal./kg. of clinker, however, the waste gas temperature only reached a maximum of 145 deg. C. At the present time, a small plant working on this principle has been erected in France.

The clinker qualities of sinter band kiln clinker from raw slurry are not inferior to the corresponding rotary cement clinker. The following data were obtained:

(Continued on page 106)

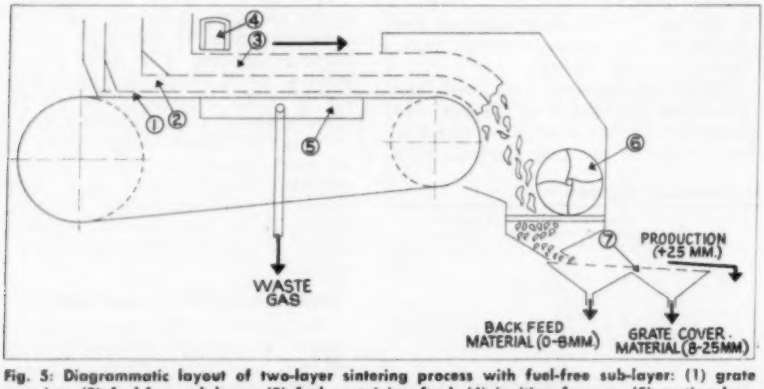
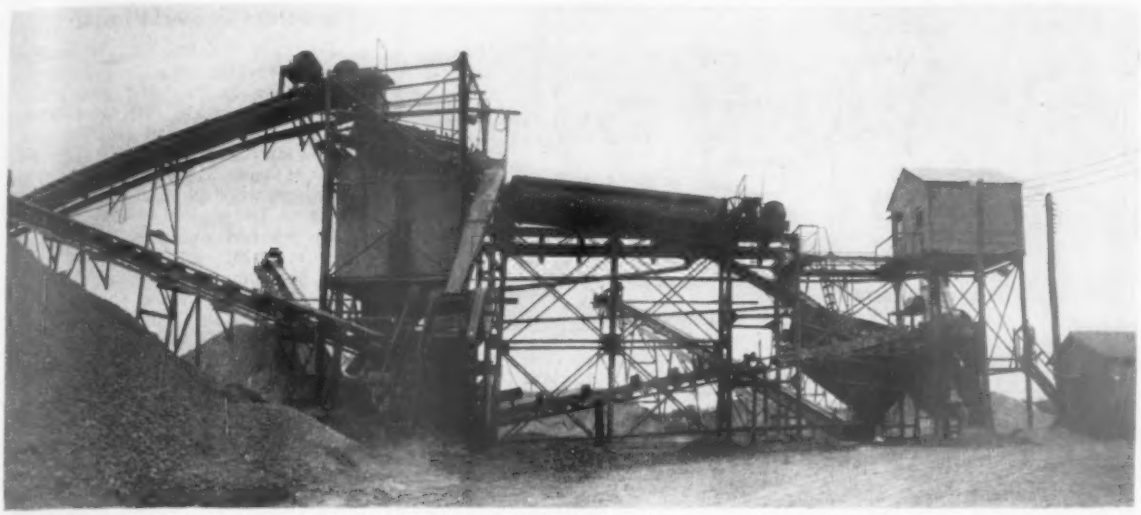


Fig. 5: Diagrammatic layout of two-layer sintering process with fuel-free sub-layer: (1) grate covering, (2) fuel-free sub-layer, (3) fuel containing feed, (4) ignition furnace, (5) suction box, (6) toothed rolls and (7) classifiers. Back feed includes dried raw slurry meal

UNIVERSITY OF MICHIGAN LIBRARIES



General view of plant. Feed belt conveyor (upper left) delivers to two-deck screen. Throughs go to sand box (left center); oversize is chuted to jaw crusher (center foreground); intermediate sizes are washed in a rotary scrubber-screen (right center). Final screening is on two-deck vibrating screen at lower end of rotary scrubber-screen. Material from the jaw crusher can be sent either to the primary screen or to storage

DEPLETION NECESSITATES LONG RAIL HAUL

Rio Grande City, Texas, plant of Fordyce Gravel Co. ships finished product almost 50 miles since exhaustion of nearby deposits

By WALTER B. LENHART

THE RIO GRANDE CITY, Texas, operation of Fordyce Gravel Co. is now four years old. It came into existence because of a situation that finds many parallels throughout the United States—depletion. Exhaustion of suitable gravel deposits in and close to the more populated sections of the lower Rio Grande valley reached the point that to meet its obligations to the construction industry in the area it serves, Fordyce Gravel Co. had to abandon plants and worked out deposits near the populated areas and go to the extreme westerly end of the railroad serving the lower Rio Grande valley to build this plant. It is almost 50 miles from the plant, in the extreme southerly tip of Texas, to the more populated areas. The cost of the plant, plus the added cost of the dead rail haul, are cost factors that had to be absorbed, for the most part, by Fordyce Gravel Co. So depletion is an extremely important subject to these producers and others in the area.

The lower Rio Grande valley is a little empire in itself. It is, practically speaking, surrounded by desert country but this fertile valley along the Rio Grande river includes the towns of Brownsville, Harlingen, Westlaco, McAllen, Mission and others. Rio Grande City at the end of the railroad is in an area that can be classed as desert. There is little or no market for sand and gravel in the immediate area. Falcon dam, described in July, 1952, issue of ROCK PRODUCTS, is about 30 miles upstream.

A rough separation is made by the primary two-deck screen (upper left). Throughs fall to sand box (left) while the plus fraction is chuted to a jaw crusher (lower right) and the product returned to the primary screen or sent to storage

Suitable concrete aggregates in the valley are confined to a thin geological stratum that is, in most cases, covered with considerable overburden. At Rio Grande City the company is stripping from 13 to 15 ft. of top soil to get at 15 ft. of gravel. This 15-ft. bed has a high sand content; possibly 50 percent will pass a ½-in. mesh screen.

To get any appreciable yearly tonnage a large area has to be worked and unless the railroad is extended upstream (an unlikely possibility), the lower Rio Grande valley faces in the forseeable future total exhaustion of its gravel deposits. Then the construction industry may have to get its basic building material from the Victoria, Texas, area. The net result will then be a more rapid depletion of the Victoria deposits which are by no means limitless in size.

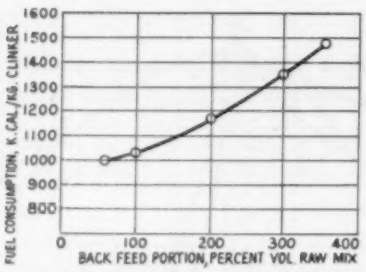


Fig. 3: Fuel consumption as a function of the back feed portion in the sinter portion

Fig. 3 which shows the relation of the fuel consumption as the returned material proportion in the sinter mixture. If the fuel consumption is evaluated at 100 (Fig. 4) with an addition of 100 percent returned material, then the fuel consumption up to a feed-back material proportion of 300 percent is only increased by about 35 percent of the original value.

This fact makes it possible to dry out the raw cement slurry with the addition of so much returned material, until the mixture has the required moisture content for the sintering. The optimum water content of the granules for sintering amounts to about 12-14 percent calculated on the total dry substance (raw mix, returned material, fuel).

With the sintering of the raw mix, the addition of the feed-back material provides a strategic aid. It is obtained by sieving out the slightly burned as well as the fine grained sinter below 6 mm. from the well sintered mass. As soon as raw slurry is processed, however, the returned material acts as a drying agent, in addition to the functions mentioned. Special value is accordingly placed on good suction possibilities, which can be installed under certain conditions.

It has been mentioned previously that the waste gas from the last third of the sinter grate reaches temperatures up to 350 deg. C. If it is possible to use this heat to any considerable extent, then there results a thermal increase of about 150 k.cal./kg. of clinker.

This heat can be used for the evaporation of part of the water contained in the raw slurry, complete removal of which is principally responsible for the higher heat consumption compared with the processing of raw mix.

For drying a part of the raw slurry with the waste gases, various technical possibilities are presented. For example, the hot gases can be drawn off by a special exhaust fan and brought into contact with the slurry in separate drying equipment. The raw mix which is formed in this way can then be mixed with the chief part of the slurry, with the fuel and with the returned, feed-back material.

It is also possible, however, to utilize the waste heat directly on the grate. This is accomplished by passing the waste gas through a sub-layer of fuel-free nodulized material which is placed directly on the grate and which is prepared from slurry and returned material. The water

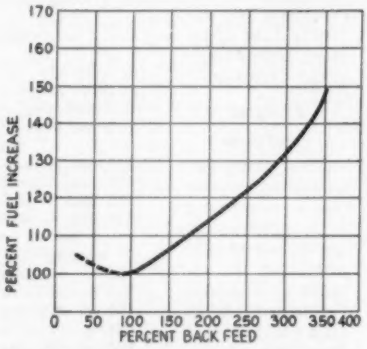


Fig. 4: Percentage increase of fuel consumption in relation to back feed proportion

evaporates and a part of the $CaCO_3$ is decomposed. This layer does not reach the sintering point, however, and on sieving out it subsequently passes into the classified portion, which during the course of the process becomes mixed with the slurry.

The working stages of this process can be followed by means of the diagram given in Fig. 5. As is customary, the grate (1) is first charged with a 3 cm. thick loading of finished sinter of particle size 8-25 mm. On this there is laid, according to requirements, the fuel-free sub-layer (2) consisting of cement raw slurry and returned material. Over this is placed the normal sinter loading (3) which contains the necessary solid fuel for the sintering process. Beneath the ignition hood (4) the fuel is ignited, and the vacuum induced in the windbox (5) by a draft fan serves to maintain the combustion. On being discharged, the whole grate loading passes through toothed rollers (6) and is separated on a vibrating screen (7) into sizes of minus 8 mm., plus 8 mm. minus 25 mm. and plus 25 mm. The grain size below 8 mm. contains, in addition to the fine grained material, the incompletely burned sinter and also the dried raw slurry. This mixture circulates in the system. The grain size of 8-25 mm. provides, as far as is necessary, the grate loading and any left over from this use passes with the oversize (plus 25 mm.) to the clinker grinder.

The most favorable working conditions were ascertained in various tests of individual slurries in which it was found that the simple sintering of slurry with the addition of return material and without waste heat recovery is best.

With a thermal consumption of about 1630 k.cal./kg. of clinker, a slurry with about 38 percent water and with return material in the ratio of 1:1.35, as well as additions of fine coke and fuel, will give an output of 8 tons of clinker per square meter of grate area. The waste gas temperature reached a maximum of about 350 deg. C.

For a further series of tests, some of the available waste gas was utilized to convert a corresponding amount of raw slurry into dry raw mix. This was then granulated with raw slurry, return material and fuel. The return material portion was reduced to 1.25:1. With this method of working, however, the fuel content could be reduced from 1630 down to 1420 k.cal., i.e., a reduction of around 29 percent.

With the third series of tests, separate drawing off of the hot waste gases was avoided and the band-grate kiln was worked with a fuel-free sub-layer which contained as much slurry as corresponded to about 20 percent of the total slurry being processed. The thermal consumption here again amounted to only 1420 k.cal./kg. of clinker, however, the waste gas temperature only reached a maximum of 145 deg. C. At the present time, a small plant working on this principle has been erected in France.

The clinker qualities of sinter band kiln clinker from raw slurry are not inferior to the corresponding rotary cement clinker. The following data were obtained:

(Continued on page 116)

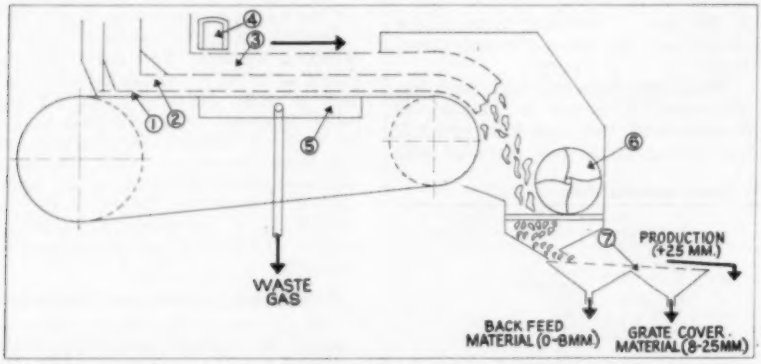
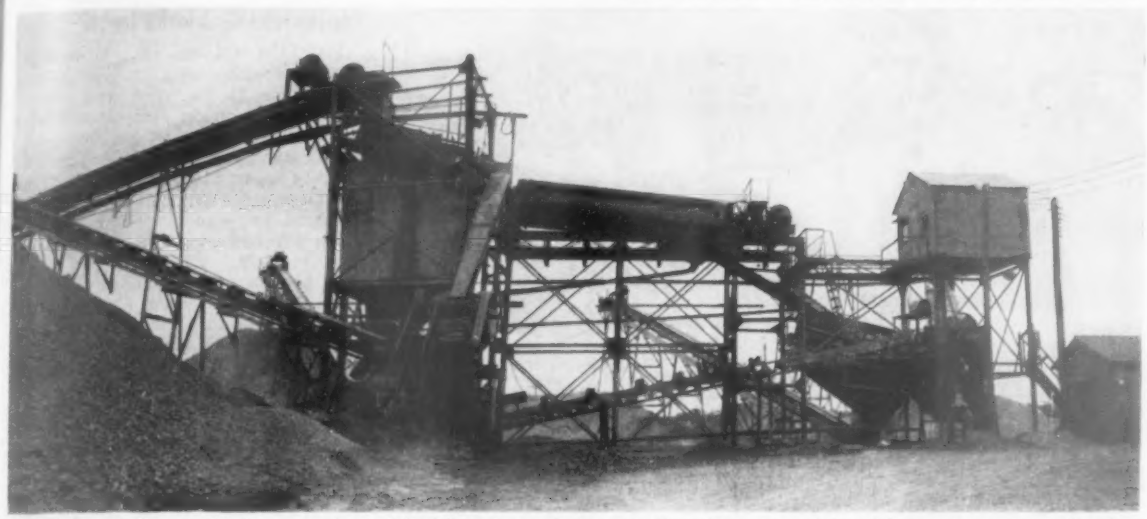


Fig. 5: Diagrammatic layout of two-layer sintering process with fuel-free sub-layer: (1) grate covering, (2) fuel-free sub-layer, (3) fuel containing feed, (4) ignition furnace, (5) suction box, (6) toothed rolls and (7) classifiers. Back feed includes dried raw slurry meal

UNIVERSITY OF MICHIGAN LIBRARIES



General view of plant. Feed belt conveyor (upper left) delivers to two-deck screen. Throughs go to sand box (left center); oversize is chuted to jaw crusher (center foreground); intermediate sizes are washed in a rotary scrubber-screen (right center). Final screening is on two-deck vibrating screen at lower end of rotary scrubber-screen. Material from the jaw crusher can be sent either to the primary screen or to storage

DEPLETION NECESSITATES LONG RAIL HAUL

Rio Grande City, Texas, plant of Fordyce Gravel Co. ships finished product almost 50 miles since exhaustion of nearby deposits

By WALTER B. LENHART

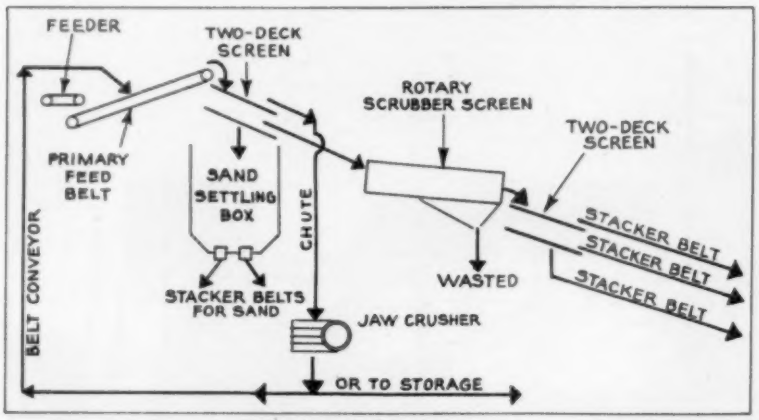
THE RIO GRANDE CITY, Texas, operation of Fordyce Gravel Co. is now four years old. It came into existence because of a situation that finds many parallels throughout the United States—depletion. Exhaustion of suitable gravel deposits in and close to the more populated sections of the lower Rio Grande valley reached the point that to meet its obligations to the construction industry in the area it serves, Fordyce Gravel Co. had to abandon plants and worked out deposits near the populated areas and go to the extreme westerly end of the railroad serving the lower Rio Grande valley to build this plant. It is almost 50 miles from the plant, in the extreme southerly tip of Texas, to the more populated areas. The cost of the plant, plus the added cost of the dead rail haul, are cost factors that had to be absorbed, for the most part, by Fordyce Gravel Co. So depletion is an extremely important subject to these producers and others in the area.

The lower Rio Grande valley is a little empire in itself. It is, practically speaking, surrounded by desert country but this fertile valley along the Rio Grande river includes the towns of Brownsville, Harlingen, Westlaco, McAllen, Mission and others. Rio Grande City at the end of the railroad is in an area that can be classed as desert. There is little or no market for sand and gravel in the immediate area. Falcon dam, described in July, 1952, issue of ROCK PRODUCTS, is about 30 miles upstream.

A rough separation is made by the primary two-deck screen (upper left). Throughs fall to sand box (left) while the plus fraction is chuted to a jaw crusher (lower right) and the product returned to the primary screen or sent to storage

Suitable concrete aggregates in the valley are confined to a thin geological stratum that is, in most cases, covered with considerable overburden. At Rio Grande City the company is stripping from 13 to 15 ft. of top soil to get at 15 ft. of gravel. This 15-ft. bed has a high sand content; possibly 50 percent will pass a ½-in. mesh screen.

To get any appreciable yearly tonnage a large area has to be worked and unless the railroad is extended upstream (an unlikely possibility), the lower Rio Grande valley faces in the forseeable future total exhaustion of its gravel deposits. Then the construction industry may have to get its basic building material from the Victoria, Texas, area. The net result will then be a more rapid depletion of the Victoria deposits which are by no means limitless in size.



Flowsheet of plant operations

The Rio Grande operation of Fordyce Gravel Co. is similar to practically all sand and gravel operations where draglines do the primary excavation and cast the strippings back into worked out portions of the pit. For economic reasons no attempts are made to rehabilitate the terrain. The company has two Northwest Model 6 draglines for stripping and for loading; they are equipped with 2-cu. yd. Hendrix buckets. A fleet of Ford 4-cu. yd. dump trucks hauls the pit-run material to the primary feeder, or to a surge pile alongside the feeder. During times of no production in the pit, one of the draglines reclaims this material and casts it to the feeder.

The flow diagram shows the essentials of the plant set-up. In essence, the plant makes a rough separation on a primary double-deck screen (5- x 14-ft. Tyler). The throughs fall to a large sand box immediately below and the settled sand is withdrawn from two manually operated gates below. The plus fraction can be crushed in a 10- x 36-in. Pioneer jaw crusher and the product returned to the first screen, or sent to storage. The intermediate sizes are washed in a rotary scrubber-screen with the throughs (all sand) wasted. The final screening is on another 5- x 14-ft. Tyler two-deck vibrating screen. The five sizes produced are stockpiled over a reclaiming tunnel and can be blended on the reclaiming belt if desired. The reclaiming belt delivers to a bank of 60-cu. yd. silos mounted over two parallel railroad tracks and the railroad cars are loaded from these bins. Cars are spotted with a Davenport switch locomotive driven by a Caterpillar D17000 diesel. Coarser sizes can be given a final rinse before loading. The plant has a capacity of 200 cu. yd. per hr.

Fordyce Gravel Co. has operations at Victoria, Mathis, Sullivan City, and at Rio Grande City, all in Texas. Main office of the company is in San Antonio. R. W. Briggs is president; C. A. Chipley, vice-president and general manager, is a director of the National Sand and Gravel Association. E. A. Schneider is superintendent at Rio Grande City; E. P. Neie, plant foreman; and B. M. Purcell is loading foreman.

●

THE BUREAU OF MINES recently announced the discovery of a large deposit of relatively pure fine grain pumice at Weiser, Idaho.

Noiseless Gravel Plant?

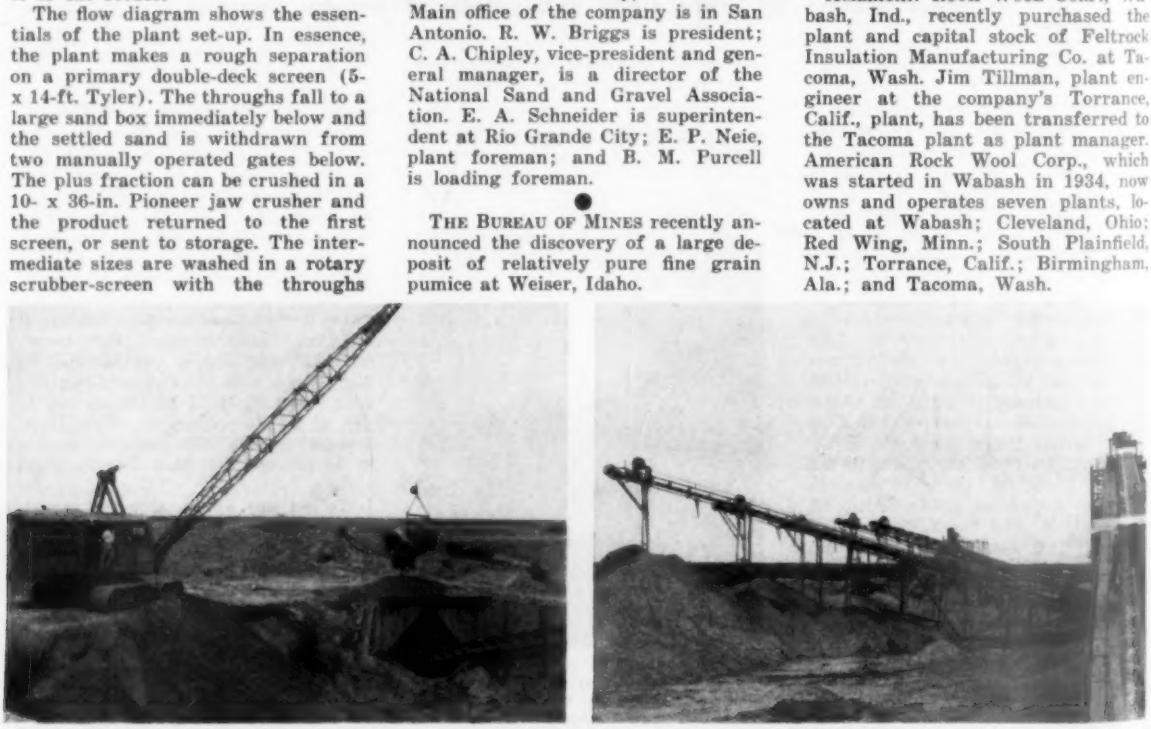
PORTLAND GRAVEL CO., Milwaukie, Ore., is working on a program to reduce noise at its sand and gravel plant as a result of complaints alleging that the operation is a nuisance. The plant, representing an investment of about $150,000, dredges from the river, tows the material in barges to shore for screening and then reships finished products to construction projects.

A preliminary report by Leslie B. Mase, a Reeder Sound Co. engineer, recommended the following changes:

1. Place 2 x 4's vertically on 16 in. centers around the tower house and pad between them with sound-absorbent mineral wool. The 2 x 4's would then be covered with a thick "membrane" of perforated wood. The north wall of the tower house which would be altered as above would be removed to permit noise to escape rather than reverberating around the enclosure.
2. A protecting wall of wood would be erected on three sides of the hopper and scalping screen which receives the material for processing from the barges. The hopper would also be roofed.
3. A noise-restraining wall would be erected at the truck loading hopper to bounce noise away from the residential area from which the complaints had arisen.

Buys Rock Wool Firm

AMERICAN ROCK WOOL CORP., Wabash, Ind., recently purchased the plant and capital stock of Feltrock Insulation Manufacturing Co. at Tacoma, Wash. Jim Tillman, plant engineer at the company's Torrance, Calif., plant, has been transferred to the Tacoma plant as plant manager. American Rock Wool Corp., which was started in Wabash in 1934, now owns and operates seven plants, located at Wabash; Cleveland, Ohio; Red Wing, Minn.; South Plainfield, N.J.; Torrance, Calif.; Birmingham, Ala.; and Tacoma, Wash.



Left: One of the draglines reclaiming gravel from the surge pile ahead of the primary feeder. Right: Five sizes of material are stockpiled over a reclaiming tunnel by these stacker belts. The reclaiming belt delivers to the 60-cu. yd. bins mounted over two railroad tracks in the background

UNIVERSITY OF MICHIGAN LIBRARIES

Crushing Practice and Theory

Part XI. Crusher product curves and tables

By BROWNELL McGREW*

WE HAVE HAD occasion to make a number of general remarks regarding the character of product delivered by crushers of various types, and under different conditions of operation. Generalities are of value only if we have some standard to which comparisons may be referred; therefore, we should like to present more specific information on the kind of product to be expected from crushing equipment under "average" operating conditions. Much of the data on which our curves and tables are based comes from operations involving those two very important types: gyratory and jaw crushers; therefore these curves and tables are more nearly representative of the work of these types than of rolls or hammermills. They may be used for these latter types however if due allowance is made for peculiarities of each type, as pointed out in our descriptions of the different machines.

The preparation of a set of product gradation curves involves a considerable amount of work in the collection of the necessary test data, and a certain degree of discrimination in sorting such data and weeding out erroneous results. There are several reasons why no set of product gradation curves can be regarded as more than reasonably close approximations. First among these is the variation in physical structure of the many materials for which crushers are used; rocks exhibit a high degree of "rugged individualism" in their reaction to crushing. This variation is frequently quite pronounced between different ledges in the same quarry.

Gradation of the crusher feed also has its effect upon the product analysis. This is true even of screened feed, although deviations from the average are not likely to be so wide as they are for unscreened material, such as quarry-run or mine-run rock. We have commented on other variable factors, such as choke versus regulated feed, straight versus curved concaves, and so forth.

Fortunately, most materials do follow a certain definite gradation pattern and, by averaging a large number of test results, it is possible to plot a group of curves which can be classed as fairly close approximations. Even though approximate, these curves are of great value in crushing-plant design, or in the solution of problems concerning additions or alterations in the plant flowsheet. They simplify the problem of selecting secondary and tertiary crushers, as well as elevating and conveying equipment, and they are invaluable in the calculation of screen sizes. In short, they eliminate much of the old-time guess work in the preparation of the plant flowsheet.

*Allis-Chalmers Manufacturing Co., Los Angeles, Calif., district office.

Crusher-Setting, Product-Size

Gyratory and jaw crushers are always rated at certain open-side or close-side discharge settings. In order that we may select the particular curve, of a group of curves, which will most nearly represent the product of a crusher having any given discharge setting, it is important to know approximately what percentage of the total output will pass a screen opening of equal dimension. It was universal practice in past years to designate such screen openings as "ring-size" for the very logical reason that the leading screen of that day—the revolving type—was, almost without exception, fitted with sections having round holes. Now that the vibrating screen, with its wire cloth or square-punched steel plate sections, has pre-empted the field there is no longer any excuse for adhering to the "ring-size" product designation.

Table I lists approximate percentages of product passing a square opening test sieve whose holes are equal to the discharge setting of the crusher. Several different conditions are tabulated, and each condition is accompanied by estimates for four different classes of material.

In gravel pit operations it will usually be found that some one of these listed base rocks will predominate, and no great error will be introduced if this predominant rock is used as the basis for product calculations. Most base rocks will be close enough in physical structure to one of the listed varieties so that the percentages can be used for them without serious error. The same statement applies to the product gradation curves to be discussed. It must be remembered that the entire process of securing and compiling data of this nature is, at best, one which is susceptible of only approximate results.

Primary Crusher Product

It was formerly the custom to consider one set of product gradation, or screen analysis, curves as being suitable to represent the products of both primary (unscreened) and secondary (screened) feeds, making no allowance for the undersize material which is always present, to some extent, in quarry-run and mine-run materials. The average quarry does not produce as much of this undersize rock as the average mine, but the usual practice in mining operations is to scalp off most of the undersize ahead of the primary crusher, whereas this practice is the exception rather than the rule in quarry operations. As a matter of fact, where the sec-

Table I. Crusher products: percent of product passing a square opening equal to discharge setting of crusher

Type of crusher	Service	Kind of feed	Setting measured on	Limestone	Granite	Trap-rock	Ores
Jaw*	Primary	Quarry-run	Open-side	85-90	70-75	65-70	85-90
Jaw*	Primary	Prescalped	Open-side	80-85	65-70	60-65	80-85
Gyratory	Primary	Quarry-run	Open-side	85-90	75-80	65-70	85-90
Gyratory	Primary	Prescalped	Open-side	80-85	70-75	60-65	80-85
Gyratory†	Secondary	Screened	Open-side	85-90	80-85	75-80	85-90
Gyratory‡	Reduction	Screened	Close-side	70-75	65-70	65-70	70-75

Single-toggle jaw product, on screened feed, will approximate that of gyratory type secondary crushers with non-choking concaves.

*Blake type, or crushers with equivalent speeds and throws; opening measured from tip of corrugations on one jaw plate to bottom of corrugations in opposing plate.

†For standard, or reduction, types with non-choking concaves.

‡For high-speed, short throw crushers, such as Newhouse, or Type "R".

ondary crushers are fitted with straight concaves, or jaw plates, as used to be standard practice, the difference between product curves on screened and unscreened feed was not significant, and no great discrepancy was introduced by considering them under the one heading.

With the introduction of non-choking concaves in the standard gyratory crushers and reduction crushers, and the development of high speed fine-reduction crushers with high choke points, it soon became apparent that there was a substantial difference in the screen analyses of the two kinds of product, that is, crusher products on unscreened and screened feeds. The difference is especially significant in the lower part of the curve, where undersize in the feed would naturally show up, and where the cleaner breaking of the non-choke crushing chamber would likewise be reflected.

Fig. 1 and 2 show a family of curves for primary crushing of unscreened feed, such as the average quarry-run material in which the undersize (minus crusher setting) rock is present in proportions normally resulting from blasting operations. The same curves may be used for mining operations with stationary bar grizzlies ahead of the primary crusher. In such operations the amount of undersize going into the crusher will usually be about the same as for the quarry operation without prescalping.

It should be noted that the test data on which these curves are based were taken from gyratory and jaw crusher operations, but, as we have stated before, they may be used for other types of crushers if allowance is made for the characteristics peculiar to each type. As a matter of fact, so far as crushers of the Fairmount single-roll type are concerned, there is a natural compensation which brings the curves fairly well into line. The Fairmount crusher is inherently a somewhat cleaner breaking machine than either the standard gyratory or standard jaw types, but the class of rock for which the former crusher is largely used is usually subject to greater than average degradation during the blasting and loading operations in the quarry, which tends to level out the difference in crushing performance.

Using Charts

The method of using the curves is so simple as to require little comment. The vertical axes represent material sizes, which may be taken as either square or round openings—provided of course that the same shape of opening is used throughout any particular analysis. The horizontal axes represent *cumulative* percentages passing corresponding screen openings. If we wish to check the product to be expected from a crusher set at some predetermined discharge opening, we first refer to the table showing the approximate percentage of product which will pass an opening equivalent to the crusher setting. This gives us a point in the group of curves which may, or may not, be exactly on one of them. In the latter case we interpolate by following an imaginary curve between the two curves on either side of our point. We can thus tabulate cumulative percentages passing all of the product sizes in which we may be interested. Non-cumulative percentages—which are important because they are used to determine expected amounts of specific products—are simply the difference between the upper and lower cumulative percentages for the particular product limits under consideration.

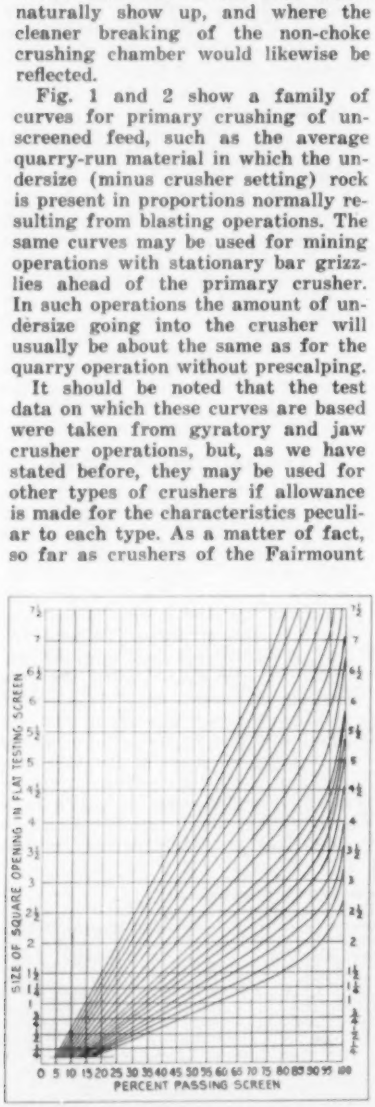
For those not familiar with the use of product gradation curves an example may be helpful. Suppose that a tentative selection of a 3½-in. open-side discharge setting has been made for a standard gyratory primary crusher to be used for crushing quarry-run limestone. Referring to the table which lists percentages of product passing an equivalent square opening, we find that 85 to 90 percent of the crusher product should pass a 3½-in. square opening. Choosing the lower percentage, to be on the conservative side, we follow the horizontal line, denoting the 3½-in. product size in the curve chart, over to the vertical line marking the 85 percent value. We find that the point we have established does not fall directly upon any of the group of curves, but lies so close to one of them that it may be used without introducing any appreciable error into our calculations.

Now, suppose that we wish to know how much of the product of our primary crusher will be retained on a 1½-in. square opening screen, so that we may estimate the size and number of secondary crushers required to recrush the plus 1½-in. contingent. Following the curve down to the 1½-in. line, we find that 43 percent of the primary crusher output may be expected to pass this screen opening; 57 percent will be retained, which means that we must provide secondary crushing capacity to take care of 57 tons for each 100 tons fed to the primary crusher.

Occasionally it happens that we wish to scalp off a salable product from the output of the primary crusher; for example, a plus 1½-in. minus 3½-in. material for highway base-rock. The difference between the cumulative percentages at the 3½- and 1½-in. points on the curve gives us the amount of such product to be expected from the output of the primary crusher This is 85 minus 43, or 42 percent of the primary crusher product.

If our problem had covered a crushing condition calling for 80 instead of 85 percent passing the opening equivalent to the crusher setting, we would have found that our point fell exactly on a curve, regardless of what crusher setting we had selected. This is because all of the family of curves are based on the 80 percent line. Obviously a group of curves might be based on any percentage line, but it is usual practice to choose the 80 or 85 percent values.

It will be noted that the curves bend upward in very marked fashion above the 75-85 percent region. This simply reflects the tendency of practically all materials to slab, or spall, to some extent in the crusher. As a matter of fact, product gradation in this upper range (above the open-



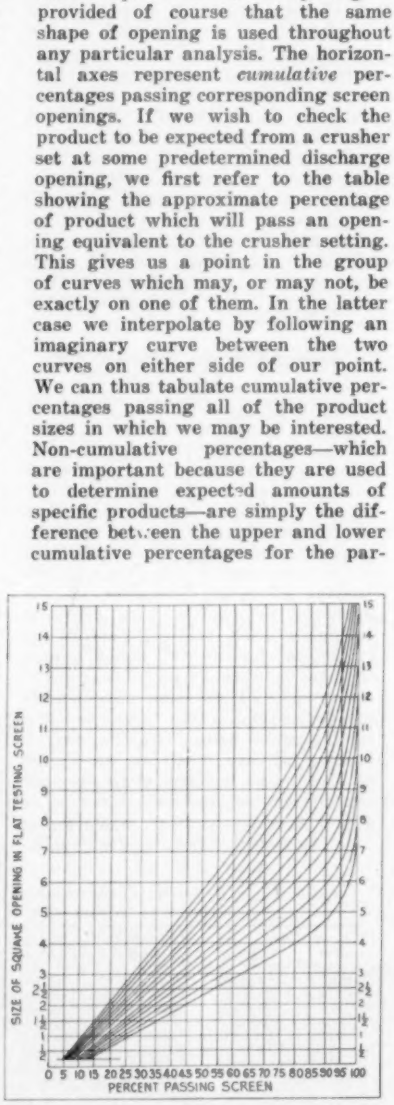


Fig. 1, left: Typical screen analyses of primary crusher products based on actual tests, for discharge openings under 7½ in. open side. Fig. 2, right: Typical screen analyses of primary crusher products based on actual tests, for discharge openings over 7½ in. open side

UNIVERSITY OF MICHIGAN LIBRARIES

side setting of the crusher) is of a distinctly uncertain and variable nature, and about all that a group of curves can do is to reflect the general tendency. Fortunately the exact screen analysis in this fraction of the primary crusher output is recrushed in succeeding stages, and all that is required is to know approximately how much of it there will be to recrush.

Although the group of curves we have been considering are intended for calulations involving primary crushing operations, they may also be used for secondary crusher products in those cases where no screening is performed between primary and secondary stages. Such an arrangement is seldom encountered in modern plant design, except where large jaw crushers, set very wide, are followed by a secondary, usually of the standard gyratory type, to reduce further the very coarse output of the jaw crusher to a size which can be handled by the recrushing, screening, and elevating equipment in the balance of the plant. In such cases it is simplest to consider the two-stage set-up as a single machine with discharge opening equal to that of the secondary crusher.

Curves for Screened Feed

The group of curves in Fig. 3 is charted from screen anlyses of the products of crushers receiving screened feed. They are useful in predicting the character of output from secondary and tertiary crushers, and are of great value in the preparation of plant flowsheets, and in calculating vibrating screen capacities. Their use in the latter connection will be discussed in the screening section of this series.

There is no need for extended comment on this group of curves; the method of taking off cumulative percentages, and non-cumulative fractions, is exactly the same as for the chart we previously discussed. The difference in the shape of these curves is attributable to the absence of fines in the crusher feed, and to the cleaner breaking action of the modern reduction crusher.

Closed-Circuit Product Analysis

The product gradation curves for screened feed, described under the preceding sub-heading, can be used as a basis for calculating approximate screen analysis of products from closed-circuit crushing stages, but the values cannot be taken directly from the curves.

For example, consider a crusher set to turn out a product 70 percent of which will pass a ⅝-in. square opening, and in closed circuit with a screen which is equipped to remove the minus ¾-in. product. Our curve shows that approximately 85 percent of the crusher product will pass the ¾-in. square openings.

Now, suppose that we wish to know how much minus ¼-in. fines we may expect from the circuit. We do not go to the curve which touches the 100 percent ordinate at the ¾-in. value; we calculate the percentage from the same curve which was used to predict the proportion of minus ¾ in. in the crusher discharge. This curve shows approximately 29 percent of minus ¼ in. in the material as it comes from the crusher, or 29 tons of fines in each 100 tons of crusher output. But, for the circulating load, we are only interested in that fraction of the crusher output which will pass the ¾-in. screen, which is 85 tons. That part of the product gradation curve which lies below the 85 percent value represents the gradation of the finished product, and 29 tons out of each 85 would be minus ¼ in.

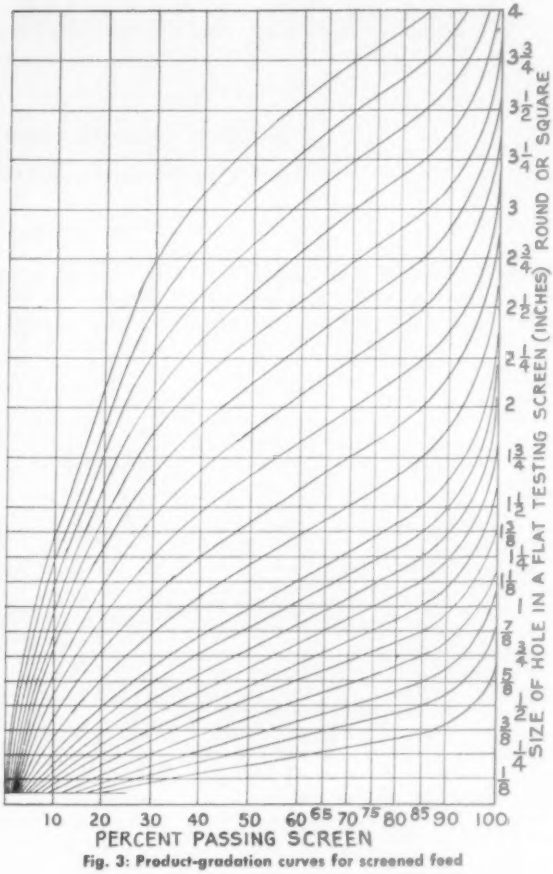


Fig. 3: Product-gradation curves for screened feed

Let x equal percentage of minus ¼ in. in the finished product, then $x:100=29:85$ or $x=34.1$ percent of minus ¼-in. rock from the closed circuit operation. Any other size of product may be estimated in a similar manner. Note that if we had used a curve touching the 100 percent ordinate at the ¾-in. value, we would have arrived at a value approximately 50 percent for the minus ¼-in. fraction—a value which is obviously erroneous for rock of average characteristics. We will comment on closed circuit crushing, and upon certain assumptions which have to be made in closed circuit calculations, in a later discussion of reduction-crushing.

Square Openings Vs. Round

Although the long established practice of designating crusher products by "ring-size" is not compatible with present-day screening practice, there are occasions when it is desirable to convert our calculations from one shape of opening to the other. So far as the curves themselves are concerned, once we have established the shape of screen opening—round or square—we can use them for either so long as we stick to one shape throughout the process of taking off percentages-passing. If, as occasionally happens, we have to deal with both shapes of screen opening in the same set of calculations, one or the other of them must be converted to equivalent sizes of the opposing shape. For example, if most of the screen openings are to be square, but one or two of them must be round, the round-hole sizes should be expressed in terms of equivalent square openings.

Inasmuch as the table of crusher settings versus equivalent product percentages is based on square openings, it is necessary to convert to equivalent round openings before this table can be used for such openings.

Table II (page 156) contains the information we need to make conversions from round to square holes, or vice versa. The two columns at the left showing equivalent sizes for flat testing screens, are the columns to use in connection with crusher product calculations.

Admittedly, listings of equivalent round and square holes, such as we show in this table, can be only approximately correct for the many different materials with which we must

(Continued on page 156)

UNIVERSITY OF MICHIGAN LIBRARIES

CELLULAR CALCIUM SILICATE PRODUCTS

Preformed foamed concrete products suggest new market potentials. Autoclaves vital to best results

By S. DILNOT*

CELLULAR calcium silicates have become of world-wide interest in recent years and this report is primarily concerned with their over-all importance to manufacturers who utilize autoclaves in the making of their normal products.

There is nothing fundamentally new in the use of air in concrete, but what is new is the development of its use in autoclaved calcium silicates and the nature of the impact of the postwar economic structure on building needs.

The report discusses the various ways in which air has been so used and shows that the manufacture of cellular calcium silicates is not only the most versatile and effective method but it also yields products of outstanding merit.

Methods of manufacture are compared and subsequently the report only deals with the preformed foam method because of its great flexibility and ease of control. Reference is also made to economics of production, the characteristics of the products and their applications.

It is shown that autoclave owners, especially those associated with the sand-lime brick industry, are in an exceedingly satisfactory position indeed to exploit this field.

The use of air. The major criticism which has long been directed against ordinary concrete and brick in the building industry is that they are heavy, with unnecessary high strength and inadequate thermal insulation. It is for this reason that so much work has been done, with the object of determining a more suitable building material, that is, one which is durable, with sufficient strength to be used in the minimum thickness required for structural stability and at this thickness to have the maximum thermal insulation. Both the manufacture and the application of the product should be associated with low man-hours per unit of building.

The impact upon a nation's economy of the previously mentioned drawbacks to concrete and brick has seriously increased since the last war, for not only has the productive capacity of the individual worker become even more vital, but rates of remuneration have increased very significantly. Of similar importance is the vast over-all quantity of power, in the form of heat, which is dissipated to the atmosphere via the walls and roofs of poorly insulated buildings. The importance of this in a country where central heating is the rule should not be overlooked.

The lines of development which have been followed in various countries have of course been dictated by a variety of economic, technical and other factors, and the amount of investigation is far too vast to be considered other than generally. But although the resultant products are widely varied, the whole field is characterized by a common denominator, namely, the utilization of air (or in some cases, gases) with the ultimate objective of producing the most satisfactory compromise between strength and thermal insulation, according to the specific applications of the products. Still, air has long been known for its high insulation value, and examples of its use as an insulator are manifold. In the concrete field it is probably true to say that the actual line of action has been to reduce the bulk density of the product by using air in some way or other, while accepting the fact that this generally means a reduction in strength and an increase in thermal insulation. Hollow concrete block resulted from such an approach to the problem and are therefore a compromise between strength and bulk density. It is rather incidental that the use of such block does effect some small measure of compromise between strength and thermal insulation, but this is seriously limited by their design wherein very substantial free paths for the passage of heat exist. In order that such products may occupy their appointed position within the framework of the picture which is being presented, they may be considered as the result of an indirect approach to the problem, wherein the utilization of air is incidental rather than intrinsic, the finished products being characterized by relatively large volumes of air surrounded by dense, thick, somewhat heat-conducting walls.

Lightweight concretes and cellular calcium silicates are much more typical of the direct approach to effect a true compromise between strength and thermal insulation because the air used is dispersed uniformly throughout the products. This is the field of major interest. During the development of the various products, however, nomenclature has become somewhat conflicting, for such terms as lightweight, aerated, gas, pore, foamed, cellular and air-entrained concrete have been used. For this report, lightweight concrete refers to that in which lightweight aggregates form an integral part of the product, and cellular calcium silicate refers to those products where air or gas as an entity is utilized to effect the necessary strength/thermal insulation compromise. Air-entrained concrete is quite a different product altogether, as only small quantities of air are used and its primary function is one of lubrication.

In lightweight concrete there are two essential components: (a) a lightweight aggregate, consisting of solid material with air dispersed through it; (b) a cementitious mortar, acting as the strength-giving component, binding the aggregate together. The use of air is therefore associated with the aggregate, and this association of air with solid material in the aggregate can arise in various ways. There are lightweight aggregates where the air has been introduced by natural causes, such as pumice; naturally occurring aggregates which are made lightweight by processing air into them, such as exfoliated vermiculite and expanded perlite; lightweight aggregates which are by-products from other processes, such as clinker; and aggregates which are by-products from other industries and are processed to introduce air, such as foamed slag.

The essential feature of this field of lightweight aggregate is the limitation placed upon the use of air by the fact that it forms part of the aggregate, the solid component acting as the carrier for the air. For example, naturally occurring lightweight aggregates have their air content already fixed, as do by-product lightweight aggregates. Processed lightweight aggregates have the upper limit of air content fixed by the chemical and physical characteristics of the material being processed and by the method of processing. It is true that some range of aeration is possible in many of the products, but effective and varied utilization of the

*Mechanical engineer, consulting technologist, England.

Text of talk presented to the Autoclave Building Products Association at its meeting in New Orleans, La., in February, 1952.

NEW Cedarrapids Built by IOWA Schrock Motorized HEAD PULLEYS

SIMPLIFY EVERY BELT CONVEYOR AND BELT-BUCKET ELEVATOR INSTALLATION

IT'S COMPLETELY DIFFERENT FROM CONVENTIONAL CONVEYOR DRIVES

Everything is contained **INSIDE** the pulley!

ELIMINATES ALL MAINTENANCE ON SPROCKETS, CHAINS, JACK-SHAFTS, V-BELTS, ETC.

U.S. Pat. No. 3548399 Others Pending

WHAT A *Motorized* HEAD PULLEY IS

THIS is a revolutionary departure from the conventional types of conveyor drives. A *motorized* head pulley is a fabricated steel pulley with *everything*... electric motor, reduction gears and all moving parts . . . contained inside the drum! It's simply a new application of the long-proven gear reduction drive, and because of its simplicity, it's the answer to the maintenance man's prayer. 70% to 90% of conveyor down time is saved by eliminating all countershafts, speed reducers, sprockets, chains, Universal shaft drive and other parts necessary with conventional pulley drives. Motorized Head Pulleys are simple to install and flexible in use, completely interchangeable and adaptable to all types of belt and belt-bucket conveyor installations. By means of a simple adapter, a single pulley can be utilized in any of several belt locations, operating various widths of belt, or changing from larger or smaller horsepower. Pulley sizes range from 5 to 30 HP and are available in various widths. A Motorized Head Pulley is safe, because there are no sprockets, chains, jack-shafts, V-belts, etc. to endanger personnel. It's compact... requires no more room than a conventional pulley. Complete protection from weather, grit and dirt also reduces maintenance. Cedarapids Schrock Motorized Head Pulleys have been job-tested for many years under severest working conditions.

HOW IT WORKS

The pulley shell rotates about the electric motor, which is held stationary by means of a torque arm attached to the conveyor frame. The speed of the shell depends upon the combined reduction ratio of the various pinions and gears contained within the pulley shell. This reduction starts with a primary pinion mounted on the motor shaft and ends in the ring gear attached to the shell. The shell in turn then drives the conveyor belt. Leads to the motor enter the head pulley through a hollow conduit passing through the drum end bell and bearing. A simple oil bath gear compartment provides a lubricating bath for the reduction gears and front motor bearing. Motor and head pulley are cooled and ventilated by holes in the drum.

GET COMPLETE DETAILS TODAY

Find out all the advantages of converting your conveyor installations to motorized efficiency before you need head pulley replacements. One internationally known company has 50 Motorized Head Pulleys installed on widespread conveyor operations, and plans more for every installation that requires replacement. Get complete details about every feature. See your distributor today, or write direct to Iowa Manufacturing Company.

IOWA MANUFACTURING CO.
Cedar Rapids, Iowa, U. S. A.

Built for sale in Arizona, California, Idaho, Montana, Nevada, New Mexico, Oregon, Texas, Utah and Washington.

YUBA MANUFACTURING CO.
Pulley & Sprocket Dept., Benicia, California

air contents necessitates the mechanical operation of grading. Although very good products have been made, the effect of the limitations described is illustrated by the very vast amount of work which has had to be done on these products, especially in the United States. In addition to these technical limitations, some reference may also be made to economic limitations, such as location of source of material, the costs of excavating, processing and transport.

It may be considered indicative of the relative failure of lightweight concrete to be a true compromise between strength and thermal insulation in that hollow lightweight concrete block are manufactured and used.

With cellular calcium silicate products, especially of the type with which this report is primarily concerned, air is itself the aggregate. It is unlimited in supply, available everywhere, constant in character, costs nothing in the initial excavating and very little to convert to aggregate proper. The characteristics of the final product are a straight-forward compromise between air and the strength-giving envelope. The amount of the air as aggregate and its size can be varied to meet the specific requirements of the product.

Two methods of curing are used in the production of these products: normal and autoclaving. This will be discussed later, but it should be mentioned that the much lower strength which results from normal curing as compared with autoclaving is such that the former cannot be considered as effecting a true compromise between strength and thermal insulation, for hollow block of this type also are made and used.

The pattern of the picture is now complete. It has been shown how air is utilized in various ways in concrete products to effect the most satisfactory strength/thermal insulation compromise and that cellular calcium silicates, produced by autoclaving, are the most suitable outcome. It now becomes necessary to discuss these in greater detail.

Cellular calcium silicates. Cellular calcium silicates are products wherein air or gas may be considered as the aggregate or part aggregate. Their methods of manufacture may include the normal curing procedures of ordinary concrete products, in which case "cellular concrete" might be an appropriate title, or it may include autoclaving similar to that employed in sand-lime brick manufacture, where a better title might well be "cellular sand-lime brick."

The two fundamental aspects of manufacture are, therefore, (a) aeration and (b) curing. Aeration may be effected in one of the four following ways:

(1) *Mechanical*—whereby air is entrapped in a cementitious slurry by high speed mixing and remains entrapped in bubble form by the incorporation of appropriate chemicals in the slurry.

(2) *Indirectly*—whereby large quantities of water are used in association with very finely divided raw materials and water-retaining agents such as asbestos fiber. After curing the excess water is driven off and is replaced by air.

(3) *Chemical*—whereby chemical evolution of gases is effected within the slurry, as for example hydrogen by the use of aluminum powder or oxygen by the use of hydrogen peroxide and bleaching powder, the reaction being so controlled as to effect the required expansion in the mass just prior to setting.

(4) *Preformed foam*—whereby a preformed foam containing air is prepared separately and mixed into the cementitious slurry.

Little reference will be made to the first two because the mechanical method is usually confined to medium density products of the order of 75-100 lb. per cu. ft. and reproducible results are somewhat difficult to obtain, while the indirect method yields products which have limited application due to practically all of the air present being in the form of interconnecting capillaries, and the air can hardly be considered as an aggregate, nor is the product a true cellular one. The most important processes are the preformed foam and aluminum powder methods.

The methods of curing employed fall into the following two classes: (a) normal curing, as for ordinary concrete products, both factory produced or in situ; accelerated normal curing by use of low pressure steam may also be used, and (b) autoclaving on similar lines as for sand-lime brick.

The two methods of aeration and curing are compared in some detail. In the aluminum powder process, the powder is mixed with the water and solid ingredients and the resulting slurry is cast into molds. The hydrogen gas generated by the chemical reaction of the aluminum with lime water forces the mass to expand until it overfills the mold. The mass is allowed to set, the surplus screened from the top, the cast material cut into block, if large molds are used, and then autoclaved or cured normally.

In the preformed foam method, the solid materials and water are mixed to a slurry, and preformed foam from a small unit supplying foam continuously is injected into the slurry with stirring. The aerated slurry in the mixture is cast into molds and is subsequently cut and cured. Both processes give excellent products, but the methods differ as follows:

(1) The aluminum powder method is based upon a chemical reaction which is sensitive to temperature and must be carefully controlled not only to insure complete aeration just prior to the mass setting but also with regard to the nature, size, shape and cleanliness of the powder. No such chemical reaction is involved with the preformed foam method.

(2) Aeration takes place in the mold with the aluminum powder method and a faulty mix does not become apparent until it is too late to do anything about it. Excess aeration is necessary to insure the mold being filled, and the surplus material has to be handled. In the preformed foam process, aeration is effected in the mixer, and although a larger mixer is required a faulty mix can always be remedied before filling the molds.

(3) The aerated mass cannot be pumped when aluminum powder is used, but with the preformed foam method, the aerated slurry can be pumped over very considerable distances without loss of entrained air.

(4) With the aluminum powder method the finished product has directional characteristics, the pores tending to be ovoid such that the compressive strength in the direction of aeration is appreciably less than the strength in a direction perpendicular to that of aeration. The pores are spherical with the preformed foam method and no directional characteristics exist in the products.

(5) The aluminum powder process does not lend itself to in situ work, chiefly because of the serious effect of temperature. Moreover, the maximum amount of expansion is usually restricted to about 12 in. The preformed foam method lends itself admirably to in situ work, particularly because it can be pumped, and it has been cast to depths of 12 ft.

(6) Preformed foam can be used to prepare aerated gypsum plaster products; aluminum powder can not.

(7) The cost per unit volume of air or gas as aggregate is less with the preformed foam method.

The methods of curing, normal and autoclaving, compare as follows: the strength-giving component of normal cured products is a gel, and the strength is developed relatively slowly, whereas autoclaving produces the strength-giving crystalline calcium silicate hydrates in 10 to 24 hr. after mixing. These calcium silicate hydrates confer much greater strength to the products and, what is equally important, very much lower wetting and drying movements. If products from the two processes, having a density of about 40 lb. per cu. ft., are compared, the thermal insulation of autoclaved products is slightly better, the strength is three times as great, the drying shrinkage only one-quarter, and the wetting movement only one-half of that for the normal cured products.

For products of equal strength, the autoclave process uses appreciably less raw materials and gives a very markedly superior product, for which transportation costs are much lower. One essential feature of the autoclave process in contrast with normal curing is of course the fact that lime can be used as a raw material.

UNIVERSITY OF MICHIGAN LIBRARIES

you can go down and get it 15" below grade

you can go up and get it 15 feet above grade

—and do it with CROWD AND HOIST . . . no wheel traction . . .

If you are doing excavation work you probably realize the mechanical advantages of big shovels—simultaneous and independent hydraulic crowding and hoisting, variable crowd action at any dipper position, changeable buckets, etc. But, do you know all these advantages have been engineered into the Dempster-Diggster to give you a faster, more versatile excavator, on pneumatic tires with a 1 cu. yd. capacity. In addition the Dempster-Diggster does anything a conventional front end loader can do—and does it faster at less cost with its 1½ or 2 cu. yd. bucket. In excavation the Dempster-Diggster is without equal for working in tight places . . . dumps at 11'3" height . . . travels at truck speeds from job to job. The versatile Dempster-Diggster is a fast, power-packed excavator and loader you can't afford to be without! Write today for our new catalog No. 1032. A product of Dempster Brothers, Inc.

DEMPSTER DIGGSTER
TRADE MARK REG.

DEMPSTER BROTHERS, 3102 N. KNOX, KNOXVILLE 17, TENNESSEE

All the above may be summarized by saying that, (1) the preformed foam method has very marked advantages over all other methods and a wider versatility in application, and (2) the autoclave process produces very much superior products than does normal curing.

Autoclaved Products by the Preformed Foam Process

The basis of the manufacture of autoclaved cellular calcium silicate products is the formation of crystalline calcium silicate hydrates by chemical reaction between calcium oxide and silica, in the presence of water, at temperatures of the order of 140-200 deg. C. The calcium oxide may be present in the form of ordinary lime or hydrated lime, including carbide sludge, or of the lime liberated during the setting of portland cement or of excess lime in basic slag, etc. The silica may be available from a wide variety of naturally occurring or artificially produced materials, including many waste products, such as pit sand, washing waste, pulverized fuel ash, pumice, mountain ash, clinker, calcined shale, slate or clay. The aggregate is ordinary air used in the form of air bubbles with envelopes of stable foam.

Normally, the solid raw materials are used in the finely divided state, for, other things being equal, the more finely divided the raw materials, the greater the strength of the finished product. The degree of subdivision used, however, is determined by the desired physical characteristics in the final product. For naturally occurring or by-product materials which are already too finely divided or have too high a surface area, the necessary balance in the mix can be achieved by using a percentage of coarser aggregate such as pit sand, or a lightweight aggregate such as pumice, exfoliated vermiculite, foamed slag or expanded slag.

High pressure steam autoclaving is necessary for the formation of the required crystalline calcium silicate hydrates, performing as it does the double function of increasing the temperature of reaction and maintaining a saturated atmosphere. Operating pressures range from 100-160 p.s.i., the higher the operating pressure the shorter the curing cycle to give the required strength in the product. Curing cycles range from 10 to 20 hr., depending upon the operating pressure, the reactivity of the raw materials, the thickness and required physical characteristics of the products being made.

The sequence of manufacturing operations is as follows: (a) preparation and handling of raw materials, (b) mixing, (c) foam injection, (d) further mixing and casting into molds, (e) preliminary setting, (f) cutting, if gang molds are not used, (g) autoclaving, (h) discharging and storing, (i) cleaning and assembly of molds.

The preparation and handling of the raw materials may include drying and blending and other steps depending on the material's nature. Mixes are controlled by weight for the solid components, by volume for liquid components, and by time for the air component. The air, in the form of foam, is injected into the slurry of the mixed raw materials and water. After further mixing, the aerated slurry is cast into molds and allowed to set for a period in order to acquire sufficient green strength to be able to stand its own weight and to resist air expansion during the initial stage of autoclaving. The required length of time depends upon a number of factors, chief of which is temperature. The cast material is then cut into the required sizes by various techniques and autoclaved. The general flow of operations is very similar to that for ordinary sand-lime brick, and the operation of the autoclaves is also similar, including the by-passing of steam.

Characteristics of products. As so many raw materials may be used in varying states of subdivision, and the degree of aeration covers a wide range, it is obviously not possible to give detailed physical data to cover all the products. Nevertheless, they have some common characteristics, such as:

(a) much higher thermal insulation bulk density and transverse compressive strength ratios than ordinary concrete products,

(b) high durability,

(c) high fire resistance, due both to the inert nature of the composition and to the high thermal insulation,

(d) excellent workability, in that they can be cut, chased, screwed, drilled, etc., with relative ease,

(e) excellent keying properties for mortar and plaster renderings,

(f) high resistance to the passage of water vapor, good resistance to the passage of water and consequently good resistance to freezing and thawing; these characteristics arise from the relative absence of capillaries in the products,

(g) excellent hygienic properties in that they offer neither shelter nor food for vermin,

(h) satisfactory sound insulation when rendered,

(i) high light reflectivity, when colored raw materials are not used, and

(j) safety and ease of handling.

As an example of the physical characteristics of a typical product, the data below apply to a structural quality which has been devised to effect a compromise between strength, thermal insulation and wetting movements.

Applications of products. As the preformed foam process lends itself so admirably to the manufacture of both autoclaved and in situ products, reference is made to both types of applications, the former being both structural and insulating and the latter essentially insulating. By far the greatest application of the autoclaved products is in the field of structural and insulating qualities of building slabs and block of varying sizes, tending to center around 18 x 9 in. by the required thickness. Such structural quality block have compressive strengths of 700 to 1000 p.s.i. while partition-type products have strengths of 400 p.s.i., approximately. Generally speaking, this means that ordinary pit sand or the like can be used in the manufacture of partition units, but additions of finer siliceous materials are needed for the structural strengths.

Larger units than block are extensively used in the form of reinforced structural roof slabs, insulating roof slabs, ceiling slabs and floor slabs. The width of the slabs remains fairly constant at about 20 in., although lengths range from 3 to 20 ft. Such slabs are covered with normal decking materials when exposed.

In situ applications are essentially insulating, and roof screeds form a typical example. Aerated slurries of 20 to 30 lb. per cu. ft. density are poured into position and allowed to set. Insulation of district heating schemes by this means is finding wide application in England.

Cold storage constructions are a typical example of the manner in which both the autoclaved and in situ qualities can be associated to very great advantage. Inner and outer layers of 4 in. thick autoclaved block or slabs are constructed with a cavity of 6 in. After erection of the walls, the cavity is filled with a cementitious slurry of about 25 lb. per cu. ft. density. Thermal transfer through such a wall is only 0.055 B.t.u. per sq.

Physical characteristics of typical product

Density		Compressive strength	
(a) dry	44 lb. per cu. ft.	(a) dry	1000 p.s.i.
(b) with equilibrium free moisture	47 lb. per cu. ft.	(b) with equilibrium free moisture	850 p.s.i.
		(c) saturated	700 p.s.i.
Thermal conductivity			
(a) dry		1.1 B.t.u./sq. ft./hr./deg. F./in.	
(b) with equilibrium free moisture		1.2 B.t.u./sq. ft./hr./deg. F./in.	
Wetting movement			
(a) to British Standard Specification 834		0.06 percent	
(b) to equilibrium free moisture		0.03 percent	

UNIVERSITY OF MICHIGAN LIBRARIES

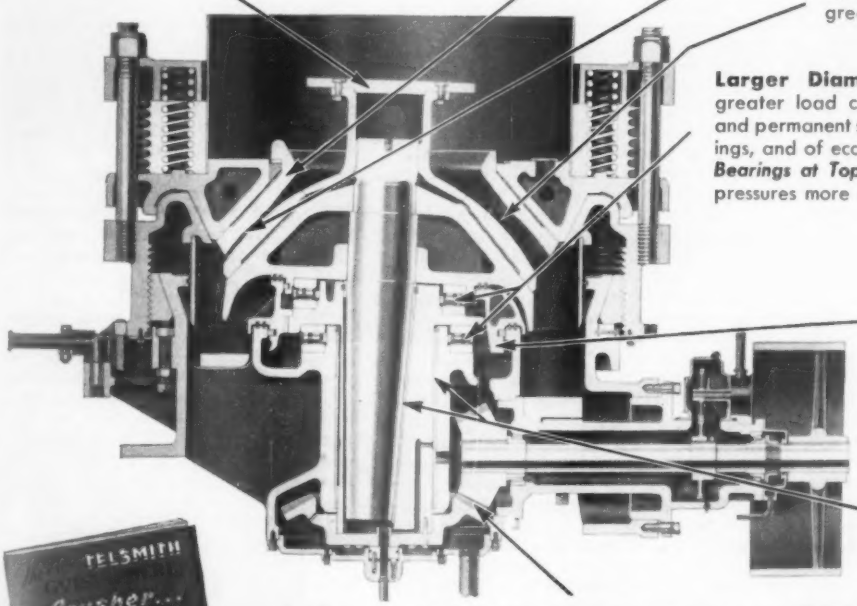
Outstanding FEATURES OF THE TELSMITH® *Gyrasphere*®

Feed Distributor gives an even distribution of the feed around the entire feed opening, resulting in a more uniform crushed product.

Gun-Lock for Holding Concave Ring — Automatic self-tightening, requires no bolts, and is easier to change.

Longer Parallel Crushing Zone gives a finer, more uniform product with a larger percentage down to size.

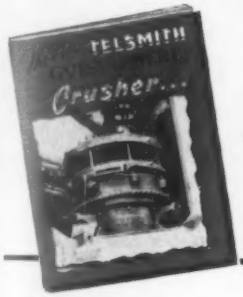
Longer Crushing Stroke gives greater capacity and less packing.



Larger Diameter Roller Bearings with greater load carrying capacity. Give perfect and permanent shaft alignment in eccentric bearings, and of eccentric in main frame. ***Both Roller Bearings at Top of Eccentric*** carry all crushing pressures more directly into heavy main frame.

Patented Rotary Seal with piston ring and labyrinth seals, gives most perfect protection against entrance of dust or water, or loss of lubricant.

Higher Eccentric Bearings give more bearing area in the upper zone of greatest crushing pressures, assuring more permanent shaft and eccentric alignment and longer bearing life.



Send for Bulletin No. 274

Main Drive Gear At Bottom of Eccentric assures more perfect and permanent alignment of gear and pinion, giving smoother running and longer life for both gear and pinion and less strain on countershaft bearings.

Y-12

STYLE FC
FINE CRUSHING

SMITH ENGINEERING WORKS, 508 E. CAPITOL DRIVE, MILWAUKEE 12, WISCONSIN

Cable Address: Sengworks, Milwaukee

51 East 42nd St. New York 17, N. Y. • 211 W. Wacker Drive Chicago 6, Ill. • 713 Commercial Trust Bldg. Philadelphia 2, Pa. • 238 Main Street Cambridge 42, Mass. • Boehck Eqpt. Co. Milwaukee 3, Wis. • The McLean Co., 3525 Lakeside Ave. Cleveland 14, Ohio

Marens Eqpt. Co., 432 Main St., Rochester, Mich. • Clyde Eqpt. Co., Portland 9, Ore., & Seattle 4, Wash. • Mines Eng. & Eqpt. Co., San Francisco 4, Calif.

Rish Eqpt. Co., Charleston 22, & Clarksburg, W. Va.—Roanoke 7, & Richmond 10, Va. • Interstate Equipment Co., Statesville, N. C.

ft. per hr. per deg. F., which is equivalent to a 6 in. thickness of the very much more expensive cork construction.

Other applications which may be mentioned are cores for fireproof doors and backings for furnace linings.

Economics of production. The production of autoclaved cellular calcium silicate products, even as completely new ventures on a large scale, has been found to be so attractive that during the last few years plants have been erected, are being erected or are planned in a number of countries, namely, Germany, France, Belgium, Norway, Sweden, Spain, England, Poland, Israel, South Africa, Russia and Australia. The output from these factories varies from 20,000 to 125,000 cu. yd. per yr. and, although the capital outlay is appreciable for the large completely new plants, the profit margin is such as to make the ventures very worth while.

Cellular calcium silicate products can not only be made at a low cost from a wide variety of naturally occurring or artificially produced raw materials, many of which are waste by-products, but the process lends itself to a high degree of mechanization, and the finished product commands a high selling price. In assessing the real merit of such a building material, the basic factor which is of fundamental value to everyone, including the nation, is the cost of finished erected walling. The manner in which cellular calcium silicate products contribute to the low cost of finished construction but commands a high selling price is exemplified by the following:

(1) detailed and supervised studies have shown the rate of erection with cellular calcium silicate block of an easily handled weight to be of the order of three times that for brick;
(2) large reinforced panels can be made which two men can handle without recourse to mechanical aid;
(3) the ease of cutting and chasing, screwing and general workability appreciably speeds up the placing of fixtures such as conduit and reduces waste to a minimum;
(4) low dead weight means lower foundation costs, especially for multistory buildings, very markedly reduced structural steel requirements, of prime importance today, and lower transportation costs;
(5) high thermal insulation gives larger living space and more pleasant living conditions by avoiding condensation. Heating costs are reduced appreciably;
(6) high fire resistance—the most outstanding advantage of the combination of high thermal insulation and high fire resistance, especially in multistory buildings, is the great protection given to structural steel members, thereby delaying or preventing over-all collapse;
(7) excellent key for plastering and high durability means reduced maintenance;
(8) completely inert structure means no food for vermin or termites;
(9) low heat capacity.

One final point has a direct bearing on a nation's economy: for the same degree of thermal insulation, cellular calcium silicate products only require ⅓ of the total fuel needed for the manufacture of both the raw materials and the product, compared to the needs for producing ordinary concrete or brick.

Autoclave Owners' Advantages

It will have become quite apparent already that the manufacture of autoclaved cellular calcium silicate products is of considerable importance to autoclave owners, and it is pertinent to list the salient features. The manufacture of these products is becoming an important feature of the American building industry. Once started, it will develop with the characteristic speed resulting from American ingenuity. It could develop in one, or all, of the various ways which are being followed elsewhere, namely: (a) from new plants on large-scale production; (b) from new plants on small-scale production; (c) from modified existing plants such that the steps of conversion are scaled to increasing demands for the product. Obviously, these are two fundamental requirements: production must be economic with an attractive profit margin, and an adequate market must be available.

Both of these factors are certain, and independent investigation will assuredly confirm this. Autoclave owners, especially sand-lime brick manufacturers, have an ideal opportunity in this field for these reasons:

(a) the heart of the production process is autoclaving, the total possible production being determined by the total footage of autoclaves, ignoring the diameter for the moment; the current steel situation means long delivery times for autoclaves and boiler equipment, but all this is already available to autoclave owners;

(b) the required auxiliary equipment is relatively small, consisting of a foam unit, mixer, molds and cutting arrangements, when required;

(c) manufacture of autoclaved cellular calcium silicate products is very similar to that for sand-lime brick, operating pressures and curing cycles being similar. Boiler capacities required are practically the same for the two processes. This great similarity allows gradual conversion of any plant, such conversion being effected in steps according to sales demand;

(d) autoclaved products manufacturers are already an established part of the building industry, which they understand. They are not, therefore, entering a virgin field;

(e) the required raw materials and their handling will be generally familiar to autoclave owners who no doubt control the bulk of their raw materials. The additional raw material, air, is freely available and can be converted, with little training, into the required aggregate, at a cost considerably less than any other aggregate anywhere;

(f) a high degree of mechanization can be effected in the process;

(g) although the profit margin is very attractive, there is an obvious limit to which long haulage costs can be allowed to cut into profits, even allowing for the very favorable effect on haulage which results from the light weight of the product. The optimum haulage distance for economic delivery depends on the economics of production in relation to profit, and although long hauls are being made in England it is generally felt that ultimately a distance of 50 miles will be considered the limit over there. It does not necessarily follow that such a distance will apply in the United States, but the general effect of haulage does mean that a larger number of concerns can operate in this field to everyone's advantage;

(h) the process lends itself very simply to "in situ" applications, either in association with autoclaved products or as a separate entity;

(i) not only is the required capital outlay reduced to a minimum by the factors already described, but such overhead as depreciation and loan charges will constitute much smaller items in the over-all balance sheet. There may well be additional points which have been omitted, but the above are more than adequate.

Conclusions

An endeavor has been made to give some fair idea of autoclaved cellular calcium silicate products made by the preformed foam process, indicating its superiority over other processes and describing the quality and applications of the products. More especially has it been shown that autoclave owners have an ideal opportunity to exploit this field.

Diatomite

A NEW 16-MM. sound movie showing the origin, mining, processing and uses of diatomite, has recently been released by Johns-Manville, New York, N.Y. The 36-min. movie, which is depicted in color, is entitled "Celite, The Story of How Johns-Manville Puts the Diatom to Work."

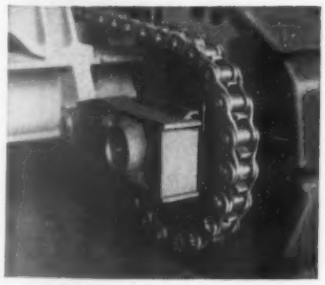
The movie explains how the diatomite deposit was created over 5,000,000 years ago, how the product is mined and converted into usable forms, and how the resulting product is used as a filter aid, mineral filler, insulating material, concrete admixture, and other uses. The film may be obtained on a free-loan basis from any of the company's sales offices in the United States or Canada.

UNIVERSITY OF MICHIGAN LIBRARIES

Teaming up for bigger profit possibilities

CHECK THESE FEATURES

- √ Completely Convertible
- √ Long, Wide Crawlers
- √ Alloy Cast Bases
- √ Tandem Drums
- √ Power Booster Clutches
- √ High Line Speeds
- √ Wide-Vision Cab
- √ Power Dipper Trip
- √ Pin-Connected Boom



Crawler outboard bearing assembly

It isn't unusual to find two or more BAY CITY machines teaming up for bigger profit possibilities because so many BAY CITY owners have been *repeat buyers* for up to 35 years. And, it isn't unusual to find scores of BAY CITY shovels, cranes and draglines with records of 20 to 25 years of service. No single factor makes them so long-wearing . . . so long lasting. It is a combination of heavy-duty design and construction features that contribute to this extremely long life and satisfactory service.

The BAY CITY Balanced Design plus the many operating and maintenance advantages have been engineered with bigger value and dependable performance. We would like you to know the full story. Why not see your nearest BAY CITY dealer or write today for catalog. BAY CITY SHOVELS, INC., BAY CITY, MICHIGAN

204

BAY CITY

SHOVELS • CRANES • HOES • DRAGLINES • CLAMSHELLS

Engineers Discuss Nonmetallic Minerals in Chicago Area

Industrial Minerals Division of A.I.M.E. features reports on silica mining, water transportation and building materials

AMERICAN INSTITUTE of Mining and Metallurgical Engineers held its midyear meeting September 3-6 in collaboration with the Centennial of Engineering in Chicago. The Industrial Minerals Division of A.I.M.E. took the opportunity to hold two general sessions and to conduct two field trips to plant operations in the Chicago area.

Shipping on Great Lakes

A morning session covered advances in industrial minerals. In a paper "Trends in Great Lake Metallic Materials," Oliver T. Burnham, Lake Carriers Association, discussed methods of loading and handling a variety of bulk materials which, in 1951, added up to 206,000,000 tons of cargo representing 118 billion ton-miles of traffic. Thus the Great Lakes transportation industry is second only to the railroads in the amount of industrial commerce handled.

Among the nonmetallic materials handled are limestone, gypsum rock, portland cement and sand, the largest tonnage being limestone which is shipped largely in self-unloading vessels. Most of the vessels are designed to permit the discharge of cargo at shore points where unloading facilities are not available. A majority of the self-unloading ships use a belt conveyor system for unloading and a discharge rate of 2000 t.p.h. is considered normal operation.

Mr. Burnham described the types of bulk cement ships in use and the use of an off-shore dock supplied by overhead bucket tramway for loading self-unloading gypsum vessels at Alabaster, Mich. The principal trend in Great Lakes transportation is toward the use of larger vessels.

Mining of Silica

A paper, "Underground Mining," by A. D. Bryant, vice-president, Standard Silica Corp., covered operations of his company in the St. Peter sandstone at Ottawa, Ill. The company is excavating both underground and from the surface.

Mr. Bryant started by pointing out that aboutt 2,500,000 tons of silica sand and silica flour are produced annually in the Ottawa district at an estimated value of $7,250,000. The use of silica sand was broken down roughly as follows:

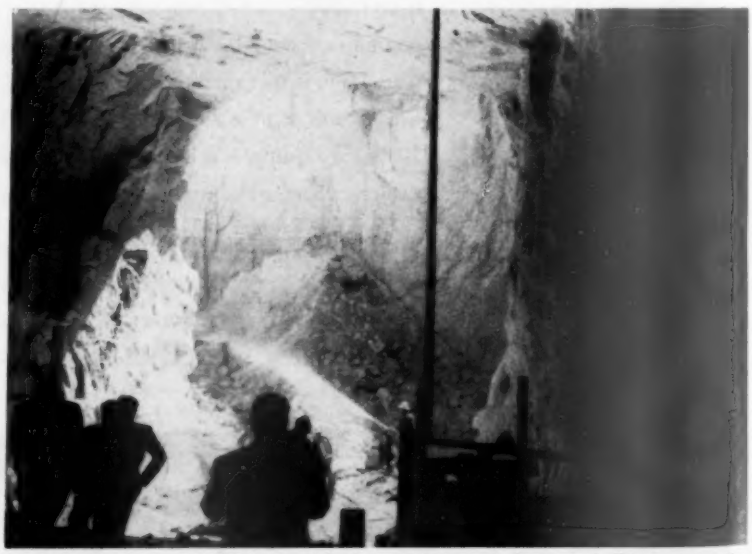
Abrasives	31 percent
Enamel, glass, porcelain, tile, etc.	21 percent
Foundry sand and filter sand	18 percent
Miscellaneous other uses	30 percent

St. Peter sandstone was described as hard and homogeneous, loosely bound by 1-2 percent clay. After blasting, it disintegrates so that it may be readily pumped which has made operations adaptable to hydraulic mining. In open pit operations, practice is to strip off overburden and top rock and to drill 6 to 8 in. dia. vertical blast holes. After blasting, the sand is washed into a sump by high pressure hydraulic nozzles, from which a sand ejector delivers the sand through rubber-lined pumps to the top of the washing plant. At the Standard Silica Corp. plant this requires pumping 2000 ft. horizontally and elevation to 130 ft. Scouring action through the pipeline is important to the removal of impurities.

Plus 4½-in. material is rejected since it is relatively high in impurities. Clay is removed in hydroseparators and the sand is dewatered to about 5 percent in drain bins. Sand is then dried in steam coil dryers and is screened into the various grades as required by industry. The Standard plant has four screening floors with electric vibrating screens, using 110 sections of 3- x 5-ft. screen deck in the production of eight grades of product. About 10 percent of the total Ottawa district production is ground into silica flour.

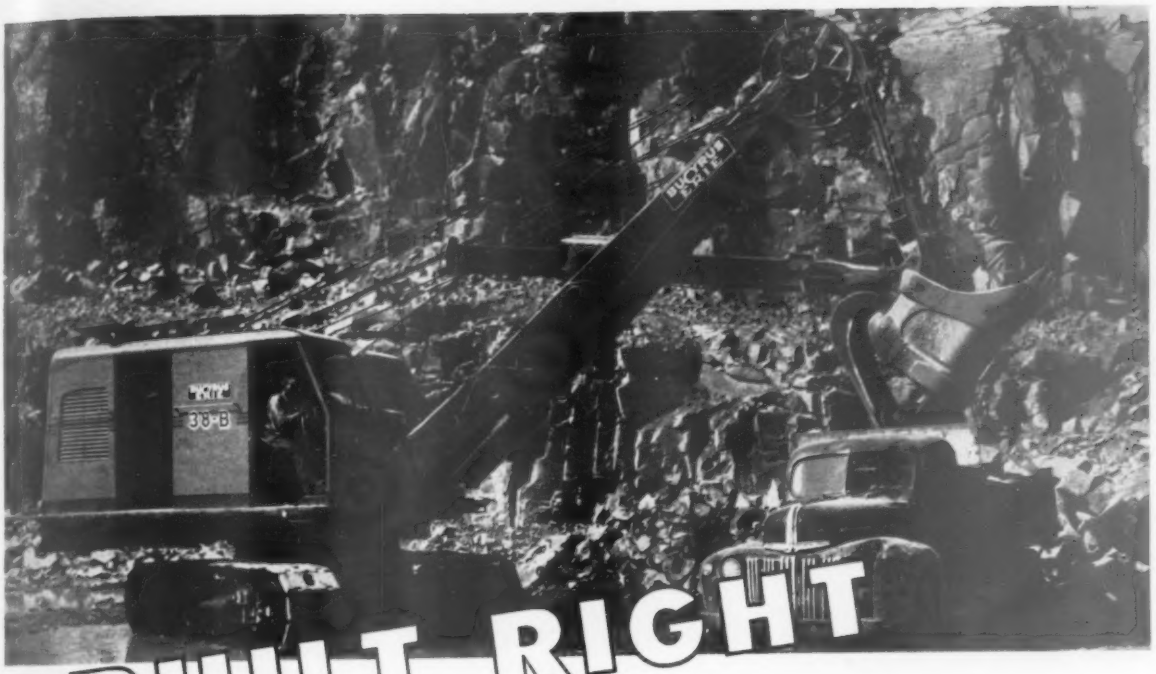
In underground mining, three pneumatic drills are mounted on a jumbo with track-type treads. A platform on the jumbo is raised and lowered by an electric hoist for positioning the drills in working a 25-ft. face of 25-35 ft. width. Two drillers operate three drills and drill a round of 52-ft. holes 12 ft. into the face. Four of the holes are cut holes and the rest are horizontal. A shot brings down about 400 tons of sand which is sluiced into a sump and pumped to the plant in the same way as for surface operation.

A relatively small proportion of total sand production is from underground mining which is done prin-



View of hydraulic monitor sluicing sand back to sand pump in foreground. This pump carries sand 600 ft. horizontally and 150 ft. vertically to the washing plant

UNIVERSITY OF MICHIGAN LIBRARIES



BUILT RIGHT for ROCK . . . the Facts show why!

Durability for hard digging shift after shift, year after year — that's a basic reason why more Bucyrus-Eries are used for output in rock than any other make of excavator. There's plenty of strength for rough rock work, plus other rock-tested features that mean steady high output:

Strength without Deadweight — from boom point to treads for greater work capacity per pound.

Big Cool-Running Clutches and Brakes — easy to operate, easy to keep cool, easy to adjust and maintain.

Heavy-Duty dippers — with cast manganese steel lip for greater wear resistance.

Smooth Power Flow — with liberal use of anti-friction bearings and simple, effective lubrication.

Individual Design for each model — with size and strength in every part to match rated capacity. That means you can tackle tough rock jobs right up to any model's rated peak regularly . . . without fear of premature, costly breakdowns.

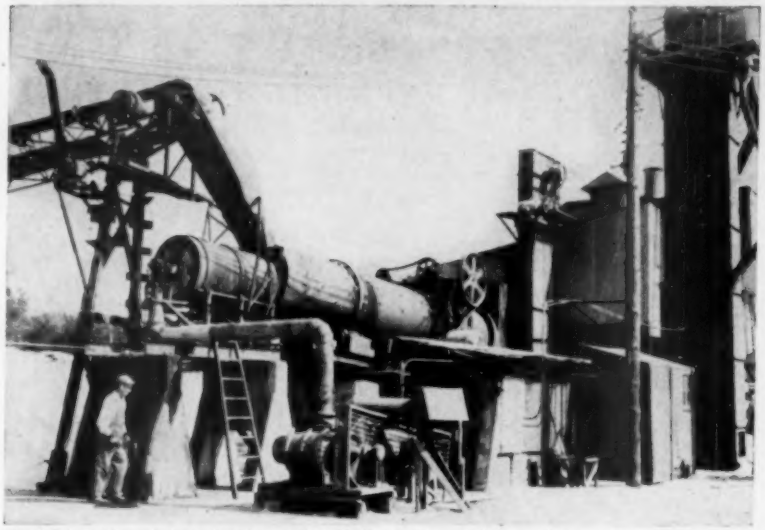
For dependable, *profitable* output on your job, see your B-E distributor soon and plan to put a Bucyrus-Erie to work for you. 90E52

3/8 to 4-yd. Gasoline, Diesel or Single Motor Electric Drive

Most Compared • Most Preferred

BUCYRUS ERIE

South Milwaukee Wis.



Manley Sand Co. drying plant in northern Indiana. The sand entered at an average 6 percent moisture and was discharged at 1 percent

cipally to get out sand for specialized markets. The oil well industry requires a closely graded product without fines which can be excavated underground with relatively little waste. Sand excavated by underground mining is capable of meeting specifiactions requiring a maximum of 0.020 percent Fe_2O_3 for paint pigment use.

As far as production is concerned, a comparison of surface operations with underground mining indicates that each method yields about 100 tons of sand pumped per man-shift. This comparison includes the removal of 4-8 ft. of cap rock and from 2-4 ft. of yellow sandstone, as well as pumping, blasting, maintenance, etc., for open quarry excavation. However, the underground operation is a little more expensive due to increased use of dynamite and blasting caps. Five tons of sand per lb. of dynamite is the yield for surface mining as compared to 1½ tons underground.

Building Materials

Five papers were presented in a session to consider advances in building materials. Paul V. Johnson, of the Structural Clay Products Research Foundation, discussed progress of this organization's work in "end-use" research over the past two years. The foundation was established three years ago as a cooperative endeavor and is supported by about 120 members.

The use of structural clay products as structural materials has diminished sharply over a period of years due to technological advances in the use of competitive materials and the development of new products, so the foundation set out to conduct research directed at the engineering use and design of the industry's products.

Among the developments discussed were insulated masonry walls, a new unit designed to make the cost of residential brick walls competitive with frame and a new theory of multi-story construction in which the force resistant structural masonry is within the building rather than in the exterior walls.

Albert Litvin, supervisor of masonry materials research, Armour Research Foundation, discussed the development and use of lightweight aggregates, covering principally the expanded shales and slags, natural aggregates including pumice, and cinders. He traced the development of their use and acceptance, and commented generally on how the manufactured aggregates are produced.

View of operations at Standard Silica Corp., Ottawa, Ill., from main sluiceway heading. Note rig on rim making new shot. Mining is being carried on only in lower ledge rock (about 30 ft. thick) so that a high proportion of 30- to 40-m. size may be used to salt up the company's old Ottawa No. 1 blast sand grade

S. T. Harrison, chief engineer, J. L. Shiely Co., Inc., St. Paul, Minn., used movies and slides to illustrate effectively some of the developments in the production of sand and gravel. He pointed to the remarkable growth of the industry and stressed the significance of some of the modern specifications in their relation to operating problems. Mr. Harrison's company has been supplying aggregates to a number of government dam projects which have required large tonnages to meet rigid requirements.

The "ultra lightweight" aggregates in the Chicago area was the subject of a paper by W. R. Jackson, Silbrico Corp., who confined his talk to the aggregates weighing 12 lb. per cu. ft. and less. He covered vermiculite and perlite aggregates, particularly.

Manufacture of vermiculite aggregate in the Chicago area started in 1938 and lightweight roof decks using a mix of expanded vermiculite and portland cement was the first use of the aggregate. Its use as a plaster aggregate has continued to increase. There are at present two plants in the area expanding vermiculite, one of which also fabricates an asphalt-vermiculite roof insulating block.

The first perlite expansion plant in the Chicago area started production in 1949 and there are now five major producers. The largest single factor in the rapid growth of perlite sales has been the promotion of ready-mixed gypsum-perlite plaster by the large gypsum plaster producers. Both poured and fabricated roof decks, and insulating floors are being installed with a perlite-portland cement mix. Sales of perlite aggregate are about 95 percent for plaster and 5 percent for concrete. Total sales of perlite aggregate in the area are estimated at $1,000,000 annually.

Concluding paper was one on the economic geography of the building material industries of the Chicago area by Kenneth A. Gutschick, Material Service Corp.

Among other papers presented by the various divisions of A.I.M.E., of possible interest to the rock products industries were (1) "Magnetic Separators in Heavy Media Plants" by Axel Kjelgaard and Ty Maki, Dings Magnetic Separator Co.; (2) "Progress Report on the Aerofall Mill" by R. C. Meaders and A. R. MacPherson, Aerofall Mills, Ltd., (3) "A Physical Explanation of the Empirical Laws of Comminution" by D. R. Walker and M. C. Shaw, M.I.T.; and (4) "The Application of Sound in Mapping Bedrock Surfaces Beneath Sediments" by W. O. Smith, U.S. Geological Survey.

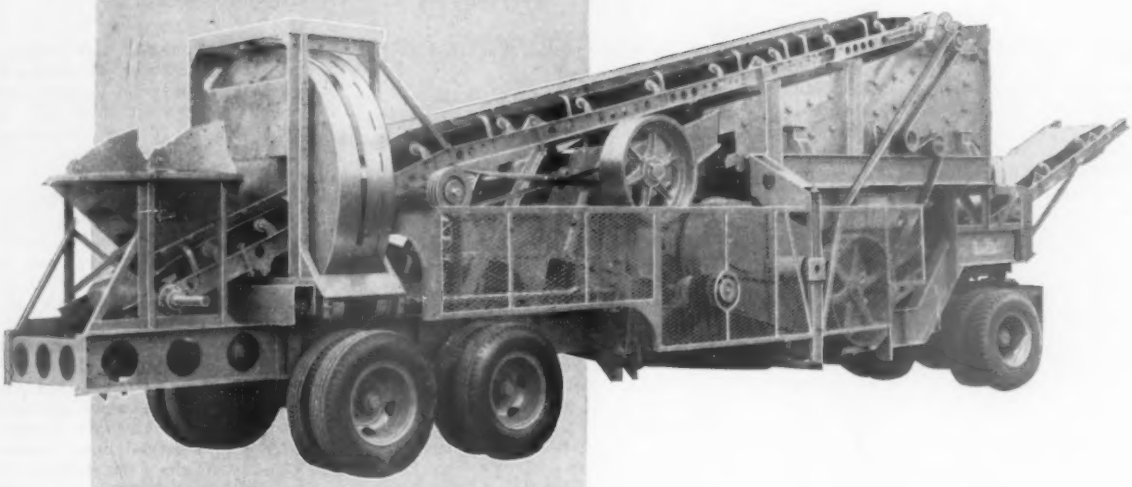
Two field trips were conducted as part of the Industrial Minerals Division program. One trip, conducted

(Continued on page 140)

UNIVERSITY OF MICHIGAN LIBRARIES

THE HOTTEST PLANT THAT EVER HIT A GRAVEL PIT

THE NEW UNIVERSAL 880 GRAVELMASTER *Senior "R"*



IT'S BIG *IT'S PORTABLE*

IT'S DESIGNED TO MEET WEIGHT LIMITS

At last! Here's the complete single unit dual-crusher gravel plant that gives you top capacity and meets state highway weight limitations. It eats up gravel at a profit-making clip and can be moved on to new locations quickly.

Operators report tremendous capacities from its big jaw, extra large rolls, and big screen. They're amazed by its fast and easy setup, low power requirement, smooth operation, and rugged strength. You'll want a Gravelmaster Senior "R" for your operations. Ask your Universal distributor for details or write for information.

TOP CAPACITY FEATURES

- **1036 roller bearing overhead eccentric jaw crusher**
- **3022 roller bearing star gear drive secondary roll crusher**
- **4' x 12' 2½ deck roller bearing inclined gyrating screen**

UNIVERSAL GAVE CEDAR RAPIDS ITS ORIGINAL FAME FOR QUALITY CRUSHERS

IN CEDAR RAPIDS SINCE 1906

UNIVERSAL ENGINEERING CORPORATION Division of PETTIBONE MULLIKEN CORPORATION

617 C Avenue N.W., Cedar Rapids, Iowa
Phone 7105

4700 West Division St., Chicago 51, Illinois
Phone Spaulding 2-9300

UNIVERSITY OF MICHIGAN LIBRARIES

Research

CEMENT RESEARCH IN JAPAN

Sixth annual convention of Japan Cement Engineering Association reports on all aspects of cement research

THE SIXTH ANNUAL convention of the Japan Cement Engineering Association was held in Tokyo, May 9-16, 1952. On the first two days 18 reports on cement research were given. The research work was mostly chemical or mechanical improvements or new plans for cement manufacturing and limestone quarrying. In the remaining five days 66 reports of research on cement and concrete were given. Those of interest to the cement chemist and engineer are summarized here.

1. Fineness of Raw Materials and Strength of Cement (application of Jander's formula on cement burning) by K. Watanabe and M. Kajii, Central Research Laboratory, Ube Kosan Co., Ltd.

The authors prepared various cement raw mixes by changing the ratio of specific surface area of clay to limestone, burned at 1450, 1500 and 1550 deg. C. They found that the ratios of 1:2 to 1:4 are most efficient and economical, and the results agree very well with those values obtained by Jander's formula for burnability.

2. Weathering of Cement by X-ray and Electron Microscope, by K. Watanabe and N. Tanaka, Central Research Laboratory, Ube Kosan Co., Ltd.

The authors examined aerated cement by electron microscope using the electron diffraction method and X-rays, and found the surface of aerated cement particles is covered by a thin film of calcium carbonate, and some quantity of cement bacillus is likely formed in them.

3. Effect of Chemical Composition and Fineness on the Weathering of Cement, by K. Watanabe and N. Tanaka. Central Research Laboratory, Ube Kosan Co., Ltd.

Cement containing much C_3S and C_4AF showed greatest resistance to weathering; the more C_3A the cement contains, the more rapidly strength decreases from weathering, due to the increase of CO_2 content in cement.

After a little weathering, cement of finer grain sizes shows a more rapid decrease in strength, while after further weathering, on the contrary, coarser cements show a faster decrease.

4. Research on the Weathering of Hardened Blast Furnace Slag Cement, by T. Yamanouchi, T. Mohri and H. Togai, Tokyo Institute of Technology.

The authors reported in the 4th Annual Convention of J.C.E.A. in 1950 that the hydration products of granulated slag with lime after a month curing are $4CaO \cdot Al_2O_3 \cdot 12\text{-}13\ H_2O$, $3CaO \cdot Al_2O_3 \cdot 6H_2O$, $3CaO \cdot Al_2O_3 \cdot 8\text{-}10.5H_2O$ and silica gel.

The same samples, after having been stored one year in room atmosphere, were again tested by microscope and X-ray, and found free of $4CaO \cdot Al_2O_3 \cdot 12\text{-}13H_2O$. From this fact the authors suggest the following reaction occurs during weathering:

$$4CaO \cdot Al_2O_3 \cdot 12\text{-}13H_2O + CO_2 \rightarrow 3CaO \cdot Al_2O_3 \cdot 6H_2O + CaCO_3 + H_2O$$

The authors are of the opinion that weathering properties of the surface of hardened slag cement are due to the absorption of CO_2, which causes the above chemical reaction, and lowers the strength of the hardened mass.

5. Study of the Abnormal Setting of Cement, by R. Naito, Central Research Laboratory, Onoda Cement Co., Ltd.

The author examined setting of cements, cured under various humidity and temperature conditions, and found the change in setting time is much affected by chemical composition of the cement and by humidity and temperature.

1) *Effect of CO_2*
Cement shows an abnormal setting when a stream of dry CO_2 is passed through it, whereas weathered in moist air free from CO_2 it shows only slow setting.

2) *Effect of alkali carbonate*
Addition of alkali carbonate in quite small quantity, such as 0.1 percent Na_2O, causes abnormal setting, while a greater addition (0.3 percent) gives quick setting, but when this rapid hardening cement is cured in moist air for 24 hr. it again becomes slow setting.

3) *Effect of temperature and moisture in atmosphere*
At a comparatively high temperature (35 deg. C.) the cement low in gypsum showed quick setting, which can, however, be reversed by mixing additional gypsum. At a room temperature of 20 deg. C. and as low as 10 deg. C., cement with high gypsum content often shows false setting.

6. Research on the Latent Hydraulic Properties of Granulated Blast Furnace Slag. Report IV. Hardening of artificial glassy slags of ternary system SiO_2-Al_2O_3-CaO, by T. Tanaka, Central Research Laboratory, Onoda Cement Co., Ltd.

The author studied the hardening characteristics of 50 kinds of artificial glassy slags of the system SiO_2-Al_2O_3-CaO, by adding 20 percent portland cement and testing strength in comparison with industrial blast-furnace slag. He found the best strength of mortar was obtained when the chemical composition ratio of artificial slag C_2S:C_2AS is 60:40.

7. Research on the Artificial Glassy Slag of the System SiO_2-Al_2O_3-CaO by Differential Thermal Analysis, by T. Tanaka, K. Takemoto and H. Kikuchi, Central Research Laboratory, Onoda Cement Co., Ltd.

It is generally believed that granulated blast furnace slag, when heated to 800 deg. C., is devitrified into the crystalline state, losing a large part of its latent hydraulic property. The authors had observed in their previous study of commercial blast furnace slag an exothermal reaction between 750-1100 deg. C. which seems to be caused by devitrification, but this exothermal reaction is not always the same for slags of different chemical composition; that is, some appear in single form, others in double or triple form, and temperature of their occurrence is also variable.

From the result of this study, they found it necessary to examine the same exothermal reaction with artificial slag of simple and known chemical composition.

For the present report the authors prepared about 20 kinds of slag of the system SiO_2-Al_2O_3-CaO, granulated by water. The change from glass to crystal by heating was examined by differential thermal analysis. The results were checked at the same time by X-ray analysis.

Translated and abridged by Dr. K. Koyanagi, director, Japan Cement Engineering Association, Tokyo.

Low in First Cost!

FOR STONE PLANT OPERATORS

FOR SAND AND GRAVEL MEN

AERO-VIBE SCREENS

YOU'LL GET *profitable* fine screening with *Aero-Vibe* screens — low in first cost and low in operating cost! They're engineered to give you the same sturdiness and low maintenance that are typical of other Allis-Chalmers vibrating screens.

Aero-Vibe screens are so efficiently designed and so soundly built they've been operated successfully at speeds up to 2000 rpm! High speed gives you a spanking vibration that puts more fines through your screen — with less in the oversize. Vibration is easily adjustable. You just change the position of circular counterweights at shaft ends.

Find out how *Aero-Vibe* screens can save dollars in your operations. Call the A-C representative in your area, or write Allis-Chalmers, Milwaukee 1, Wisconsin, for *Aero-Vibe* screen Bulletin 07B6099. A-3798

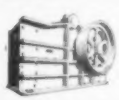
Aero-Vibe screens are also profitable for sizing or rinsing medium-coarse materials up to 3-in. feed size. Built in 2 x 4 to 5 x 10-ft sizes, open or enclosed, 1 to 3 decks.

Aero-Vibe is an Allis-Chalmers trademark.

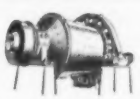
A-C ALLIS-CHALMERS

Hammermills

Vibrating Screens


Jaw Crushers

Gyratory Crushers


Grinding Mills

Kilns, Coolers, Dryers

Sales Offices in Principal Cities in the U. S. A. Distributors Throughout the World.

8. Research on the Activity of Granulated Slag, by T. Yamanouchi and K. Kondo, Tokyo Institute of Technology.

The latent hydraulic power of granulated slags differs according to kind and quantity of materials added as excitor. For instance, the chemical composition of slag suitable for blast furnace slag portland cement is quite different from that for gypsum-slag cement.

The authors prepared four kinds of cement, using granulated slag of various chemical compositions obtained by melting pure chemicals, and tested their strengths. Mixing ratios of the cements were as follows:

Type of cement		Slag	Portland cement clinker	$Ca(OH)_2$	Gypsum (raw)	Gypsum (calc.)
Portland cement-blast furnace slag cement	A	50	47	—	3	—
Gypsum-slag cement	B	82.5	5	—	–	12.5
Gypsum-slag cement	C	75	—	12.5	–	12.5
Lime-slag cement	D	85	—	15	–	—

From the testing, the suitable chemical composition for slag for each cement was found to be as follows:

Type of cement	Suitable chemical composition of slag
A	SiO_2 37-48 percent, CaO-Al_2O_3 72-63 percent
B	CaO 58-48 percent, Al_2O_3 above 14 percent
C	$2CaO \cdot Al_2O_3 \cdot SiO_2$
D	Slags of which chemical composition falls on the line connecting two points $3CaO \cdot 2SiO_2$ and $CaO \cdot 2Al_2O_3$

It was also found by this study that in certain chemical compositions the slag shows self-hardening power and also quick setting.

9. Research on the Burning Mechanism of Portland Cement, by M. Ueda, Central Research Laboratory, Onoda Cement Co., Ltd.

The author carried out differential thermal analyses with a great number of cement raw mixes varying in chemical composition. The chemical reaction supposed to be caused by each thermal change was examined by chemical, microscopic and X-ray methods.

The authors observed five typical thermal changes as follows:

1st thermal change (endothermal) at 800 deg. C. caused by decomposition of $CaCO_3$.

2nd thermal change (exothermal) at 1200 deg. C. supposed to be caused by formation of $2CaO \cdot SiO_2$.

3rd thermal change (exothermal) at 1280 deg. C. begins the formation of $3CaO \cdot SiO_2$ and the first liquid phase. The mix begins to obtain "clinker color;" $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$ is also supposed to be formed in this step, but has not been confirmed.

4th thermal change (exothermal) at 1380 deg. C. This thermal change is variable in form with raw mixes of different chemical compositions and is supposed to be caused by formation of a liquid phase.

5th thermal change (endothermal) at 1420 deg. C. believed to be caused by the transition from β $2CaO \cdot SiO_2$ to α $2CaO \cdot SiO_2$. Further work is being done to check this.

10. Research on Turbulent Diffusion for Pulverized Coal Burners, by Kenjiro Saji, Nihon Cement Co., Ltd., Nishitama plant.

The author studied the problem of turbulent diffusion for gas, oil and pulverized coal, and developed a theoretical formula for turbulent gas flame. Results of the research, together with his other investigations on combustion, were published at the fourth "Symposium on Combustion, Flame and Explosion Phenomena" at Massachusetts Institute of Technology in September, 1952. (See also ROCK PRODUCTS, August, 1952, page 152).

11. Research on the Grinding Capacity of Open Circuit Cement Mills, by S. Suzuki, Chichibu Cement Co., Ltd.

Particle distribution of cement was examined by means of an air analyzer and Blaine's air permeability apparatus, changing the output of mills, and obtained exponential formulas between particle distribution and output, kw.-hr. and output and specific surface area and kw.-hr.

The formulas were applicable for normal grinding to a fineness of 3300-3500 $cm.^2/g.$ Blaine. Grinding becomes abnormal at higher finenesses, where the formulas are not applicable.

The formulas he obtained are as follows:

(1) Formula for fineness and output

$$R = 100\, e^{-kQ^m}$$

where R = residue in container of air analyzer
Q = amount of cement ground
k, m = constants

The formula was deduced from the formula $R = 100\, e^{-kx^n}$ (where x = particle diameter) proposed by K. Chujo (*Journal of Japan Cer. Soc.*, No. 17, 1939) and Rosin and Rammler (*Zement*, No. 31, 1939) and formula $R = 100\, e^{-kZ^m}$ (where Z is number of revolutions of test mill) obtained by K. Chujo.

(2) Kilowatt-hour and output

$$W = \beta\, Q^{\gamma}$$

where W = kw.-hr./kiloton
Q = output
β, γ = constants

(3) Specific surface area (Blaine) and kilowatt-hour

$$S = -\beta_1 W^{\gamma_1} + C$$

where S = specific surface area (Blaine)
W = kw.-hr.
β_1, γ_1, C = constants

12. Overgrinding of Cement, by K. Miyazawa and K. Nogi, Iwaki Cement Co., Ltd.

It is often observed in mill practice that cement, when overground, shows quick setting, and much cement flake in form of scale is formed in products. The authors examined the overground cement with Blaine permeability apparatus and found that in overgrinding, though cement scale is formed, the specific surface area continues to increase. The gypsum content in the finer part shows no change, and premature setting of cement can be inhibited by mixing additional gypsum. From this it is supposed that the premature setting by overgrinding results from the cement surface area, which is so great that setting can no longer be regulated by the normal quantity of gypsum.

13. Determination of Free CaO in Portland Cement, by Y. Suzukawa and K. Yamane, Central Research Laboratory, Ube Kosan Co., Ltd.

The authors traced the method proposed by R. Haydon and Hatschek (*Zement-Kalk-Gips*, Vol. 4, No. 2, page 36, Feb. 1950) and compared it with ordinary glycerine methods. The new method does not use glycerine, but is carried out by treating cement with alcohol containing a certain amount of water. The difference in loss on ignition before and after treating with alcohol, multiplied by a known factor, gives the amount of free CaO.

The authors made many tests and found the method very easy to manipulate and accurate enough for daily use of free lime determination.

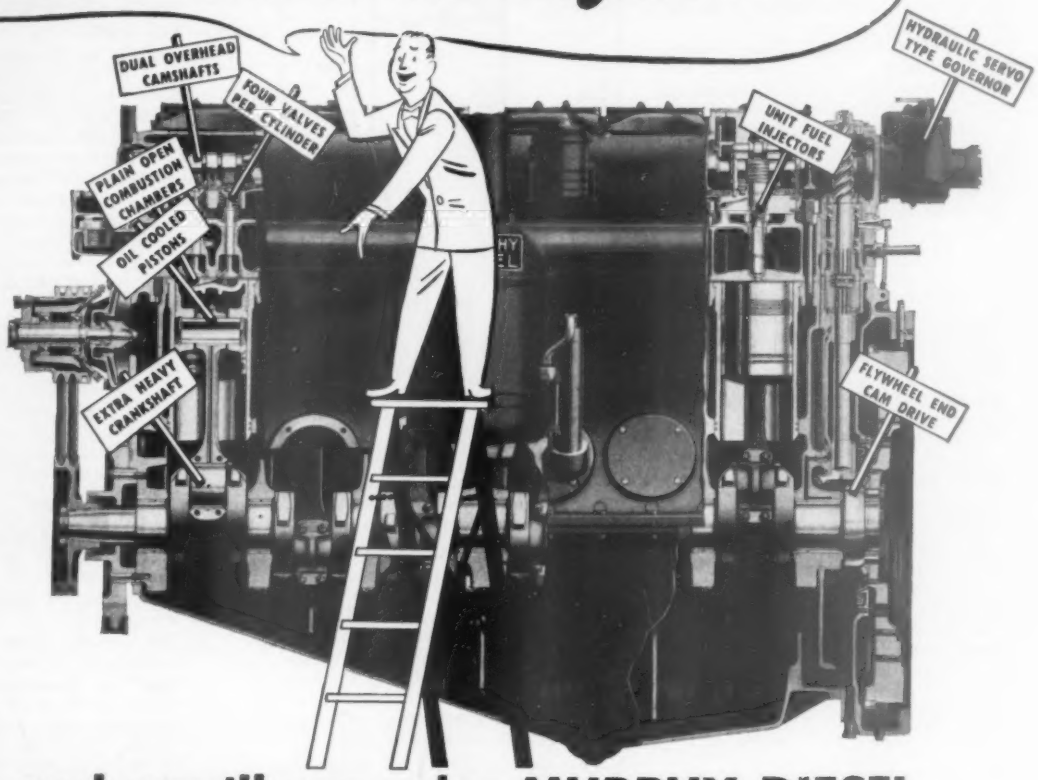
14. Determination of $Ca(OH)_2$ in Hardened Portland Cement, by K. Fujii, Chemical and Industrial Research Institute, Tokyo.

The difficulty in determination of $Ca(OH)_2$ in hardened portland cement seems to depend upon the fact that $Ca(OH)_2$ may occur not only in free form but also absorbed by calcium hydrosilicate gel. The author treated the hydrated cement with alcoholic solution of various concentrations of 2, 4, 6-tribromophenol and glycerine, determined $Ca(OH)_2$ in free as well as in absorbed state with a maximum error of 0.5 percent.

15. Rapid Determination of SO_3 in Cement by Centrifugal Separation, by Y. Ohno, Sangyo Cement and Railway Co., Ltd.

UNIVERSITY OF MICHIGAN LIBRARIES

Look inside the engine...



and you'll see why MURPHY DIESEL gives you more power, greater economy and longer engine life...

MURPHY DIESEL

Heavy duty power
for rock crushing

Murphy Diesel Engines and Power Units for portable or stationary crushing plants, 90 to 226 H. P. 1200 and 1400 RPM. Generator Sets, 60 to 140 K.W.

FOR the most part, engines look pretty much alike from the outside, but to really judge an engine you have to look inside. The Murphy Diesel isn't afraid of comparison. It offers a combination of proved design advantages available in no other engine. Check these features for yourself and ask Murphy Diesel owners—they'll tell you what these features mean in terms of good heavy-duty power, minimum fuel consumption and long engine life.

Additional information is given in the booklet, "*10 Questions to Ask a Diesel Engine Salesman*". Ask your Murphy Diesel Dealer for a copy or write direct.

MURPHY DIESEL COMPANY
5315 W. Burnham St., Milwaukee 14, Wisconsin
Tulsa Office—Sales, Parts and Service:
113-117 South Elwood Street, Tulsa, Oklahoma
Sales, Parts, Service

239

The author devised a new method for rapid determination of SO_3 in cement by centrifugal separation of $BaSO_4$, using a separating tube as shown in Fig. 1.

The method consists of the following operations:

1) Dissolving 0.3-0.4 g. cement in hot 5N HCl and filtering.
2) Adding 7 cc. of 4 percent $BaCl_2$ solution to the filtrate in the separating tube.
3) Separation of precipitate of barium sulfate in a centrifuge at 3000 r.p.m. for 1 min.
4) Reading height of sediment in graduated part of tube, multiplied by the factor, gives percent SO_3 in cement.

The time necessary for determination is about 5 min., and the result is close enough for mill control. Care must be taken since the crystal size of $BaSO_4$ is affected by temperature, concentration and the amount of barium chloride solution added, thus making the result uncertain.

16. Research on Sulfate Resisting Cement, II, by K. Asaoka, S. Uchida, M. Ishii and E. Sano, Central Research Laboratory, Nihon Cement Co., Ltd.

Test specimens made of one high early strength portland cement, one standard portland cement and two sulfate resisting cements were immersed in pure water, a 10 percent solution of sodium sulfate, and magnesium sulfate, respectively, for 7 and 28 days, and 3 and 6 months. Then the samples were taken out and chemically analyzed.

From the results of chemical analysis the authors suggested these reactions for early stages of corrosion:

1) $Ca(OH)_2 + Na_2SO_4 + 2H_2O = CaSO_4 \cdot 2H_2O + 2NaOH$
2) $Ca(OH)_2 + MgSO_4 + 2H_2O = CaSO_4 \cdot 2H_2O + Mg(OH)_2$

the third equation for a later stage of corrosion:

3) $3(CaSO_4 \cdot 2H_2O) + 3CaO \cdot Al_2O_3 \cdot nH_2O + H_2O = 3CaO \cdot 3CaSO_4 \cdot 31H_2O$

17. Tests for Sulfate Resistance of Portland Cement, by N. Takata, R. Nagano and K. Kitagawa, Osaka Jogyo Cement Co., Ltd.

All methods hitherto used for testing susceptibility of portland cement to sulfate solutions necessitate not only too long a time but also are affected greatly by the workmanship of the test piece.

The authors tested cement for sulfate resistance by a sonic method and compared the results with the disintegration index obtained by Taylor and Bogue's method (Res. Reports, P.C.A.F., February, 1944).

18. Research on Cement for Road Construction, b, K. Chujo, S. Sekino and M. Kondo, Central Research Laboratory, Nihon Cement Co., Ltd.

The authors studied special cement for road construction, comparing it with standard and high early strength cements. Expansion, contraction, Young's modulus and durability were checked using neat cement and concrete. They prepared samples of specific surface area 2000-5000 cm.²/g. (Blaine) for all cements and tested the effects of fineness on all the aforementioned physical properties.

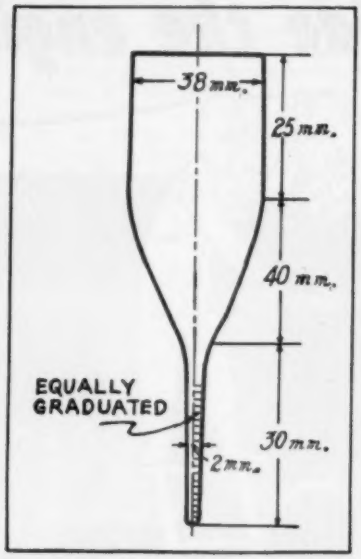


Fig. 1: Separating tube for determining SO_3 in cement by centrifugal separation of $BaSO_4$

19. Research on Heat of Hydration of Portland Cement, by S. Akaiwa and J. Mori, Chichibu Cement Co., Ltd.

1) *Heat liberation in hydration*

Effect of types of cement and addition of gypsum, calcium chloride and alkalies on the heat liberated in hydration of cement was checked using an adiabatic calorimeter.

a) In standard cement, upon increasing gypsum, heat liberation follows these steps:
acceleration→retard→slight acceleration→retard
while for cement high in alkali and SO_3, this becomes
acceleration→retard.
b) Addition of calcium chloride causes greater acceleration in cement with higher contents of C_3S. Alkali carbonates react most, accelerating all kinds of cement, while alkali hydroxide does not.

2) *Heat of hydration*

The authors studied the effect of water-cement ratio, and addition of calcium chloride and pozzolan on the heat of hydration.

a) With standard portland cement, heat of hydration increases with increasing W/C. This increase amounts to 4-8 cal./gr./0.1 W/C, in range of 0.4-0.7 W/C and at the age of 7 and 28 days.
b) 1-2 percent addition of $CaCl_2$ to normal cement causes accelerating till the age of 7 days, but at 28 days the heat of hydration is a little less than standard cement.

20. Research on Cement Setting by Means of Calorimeter and Viscosimeter, by Y. Fukushima and I. Hayashi, Central Research Laboratory, Onoda Cement Co., Ltd.

The setting time obtained by traditional methods of Vicat and Gillmore does not indicate the true setting time. The authors tried to examine cement setting by measuring changes in viscosity of cement paste and heat liberation during setting. As testing apparatus, Ostwald's viscosimeter and an adiabatic calorimeter constructed by the authors were used. The results are summarized as follows:

1) There is an intimate relation between heat liberation and setting time.
2) For portland cement with normal fineness and gypsum content, there are two high points in the velocity curve of heat liberation. The finer the cement, the shorter the length of time from start till the velocity of heat liberation reaches the maximum.
3) The cement with a deficient quantity of gypsum shows very high heat liberation instantaneously after mixing, which is weakened very quickly afterwards, while the cement with excess gypsum gives high heat liberation in an earlier period of setting. Both give quite different curves of heat liberation than cement of normal gypsum content.

21. Research on Heat of Hydration of Cement Containing Granulated Blast Furnace Slag, by T. Yamanouchi, R. Kondo, H. Asano, Tokyo Institute of Technology.

Three kinds of gypsum-slag cements, made by adding small amounts of portland cement clinker, $Ca(OH)_2$ and calcined MgO as accelerator, were tested for heat of hydration. Heat of hydration was measured by heat of solution method with samples cured for 3, 7, 28 and 90 days.

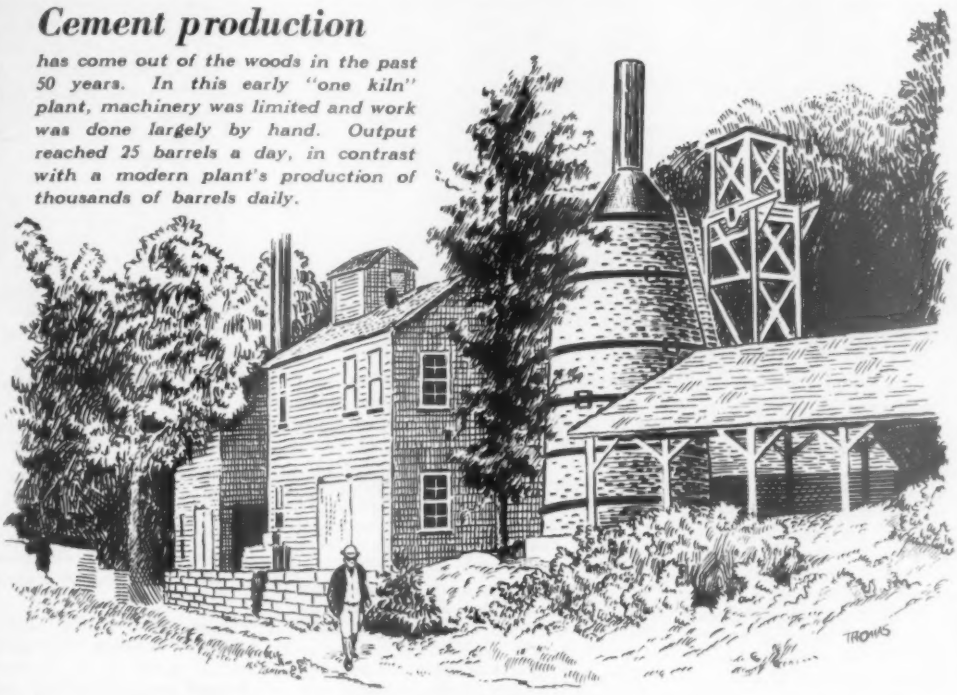
The gypsum-slag cement containing portland cement clinker showed high early strength and high heat of hydration, while those containing MgO, though not high in strength and heat of hydration initially, gave exceedingly high values after a longer period of time. The cement containing $Ca(OH)_2$ showed low strength and heat of hydration even after a long time. Values of strength divided by heat of hydration are nearly the same for all kinds of cement treated.

22. Research on the Hardness of Hardened Neat Cement, by K. Chujo, Central Research Laboratory, Nihon Cement Co., Ltd.

UNIVERSITY OF MICHIGAN LIBRARIES

Cement production

has come out of the woods in the past 50 years. In this early "one kiln" plant, machinery was limited and work was done largely by hand. Output reached 25 barrels a day, in contrast with a modern plant's production of thousands of barrels daily.



Traylor Rotary Kilns are noted for dependable service and efficient operation all over the world. Each kiln is specially designed for its particular job. Traylor Bulletin 115 gives complete information and specifications.

Because of the rapid improvement of equipment, one pioneer company, still operating, has built and discarded four plants in succession to keep pace with new developments. For 50 years, Traylor engineers have worked hand-in-hand with the cement industry, developing better equipment to produce a uniform, high-quality product in increasingly large amounts. You can rely on Traylor experience to provide the same dependable machinery for your own particular needs. Traylor has experience . . . half a century of it.

TRAYLOR ENGINEERING & MANUFACTURING COMPANY

1435 MILL ST., ALLENTOWN, PA.

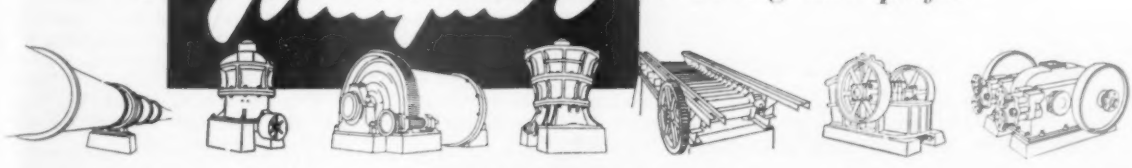
SALES OFFICES: New York • Chicago • San Francisco

Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P. Q.

OUR GOLDEN ANNIVERSARY YEAR

1902 1952

a **Traylor** *leads to greater profits*



The author found the upper part of specimens is always harder than the lower part. He also studied hardness of cement paste during setting and hardening and found that in an earlier period after setting the upper part is softer than the bottom part, while later the relation is reversed. The author also tested tensile strengths of concrete by the tearing stress method, using cylindrical test pieces, and found that the upper part of the test piece is always stronger than the lower part.

By chemical analysis and thermo-analysis, it was found that the upper part of hardened cement has a much greater lime content than the lower part.

23. Research on the Color of Cement, by S. Murakami and K. Shimomura, Japan Electronical Instrument Co., Ltd., and T. Tanaka, Onoda Cement Co., Ltd.

In order to specify the color of cement powder, about 300 color charts (2.5 hue, 0.2 value, 0.1 chroma step) for white cement, and about 400 color charts (1.25 hue, 0.2 value, 0.2 chroma step) for standard portland cement were made, based on the Munsell system recommended by the subcommittee on colorimetry of the Optical Society of America. The color matching of about 40 kinds of cement powder was mentioned.

24. Electron Microscopic Study of the Hydration of Portland Cement, Part I. Hydration of tricalcium aluminate, by K. Takemoto, Central Research Laboratory, Onoda Cement Co., Ltd.

Hydration of pure tricalcium aluminate, when treated with pure water, lime and gypsum water, was studied. Observation was made under electron microscope, with ordinary as well as with electron diffraction methods. For determination of composition X-ray diffraction was used. The kinds and forms of hydration products were changed by the concentration and quantity of solution added, and temperature, etc.

The composition of hydration products was found to be:

1) Hexagonal crystals of $3CaO \cdot Al_2O_3 \cdot 8H_2O$ in the form of thin hexagonal plates.
2) Hexagonal crystals of $2CaO \cdot Al_2O_3 \cdot 8H_2O$ in the form of thin hexagonal plates.
3) Crystals of regular system $3CaO \cdot Al_2O_3 \cdot 6H_2O$ in the form of icositetrahedra and hexahedra.
4) Thin needle crystals $3CaO \cdot Al_2O_3 \cdot 3CaSO_4 \cdot 31H_2O$.

The electron diffraction diagram could only be obtained with $Ca(OH)_2$ and $3CaO \cdot Al_2O_3 \cdot 8H_2O$, and not with other products.

25. Hydration Products of Portland Cement by Electron Microscope, by Y. Sanada, K. Miyazawa and Y. Matsuzaki, Iwaki Cement Co., Ltd.

The authors observed hydration products of portland cement with excess of water, and found $Ca(OH)_2$ in spherical form, which changed afterwards into $CaCO_3$. They observed also needle and plate crystals which are to be regarded as cement bacillus, and $3CaO \cdot Al_2O_3 \cdot nH_2O$. Besides these they observed a gelatinous substance in a later period of setting.

26. Research on Pozzolan, II. Study of reactive Al_2O_3 in pozzolan, by G. Murakami, Chichibu Cement Co., Ltd.

Little has been learned about the reactive alumina in pozzolan, which seems to be very efficient in producing higher strengths, especially early strengths of pozzolan cement.

There is a large quantity of volcanic ash in Japan, comparatively high in alumina, which has for centuries been greatly utilized as a cement admixture for marine construction. With this kind of pozzolan, the setting time of cement is not delayed as much as in the case of ordinary pozzolan cement, and comparatively high early strength is attained.

The author tried to examine the reaction of alumina in pozzolan and chose a calcined kaolinite clay as a typical sample. Analysis, soluble contents and results of chemical tests by the U.S. Bureau of Reclamation are given in the following table:

The results of examination were as follows:

1) The clay showed a very high lime absorption initially. Lime-pozzolan mix (1:2) showed flash setting, but when a certain quantity of gypsum was added, the initial setting took longer than 1 hr.
2) Addition of gypsum is favorable on the strength of lime-pozzolan mortar (tested by U.S. Bureau of Reclamation method). With 10 percent replacement of pozzolan with gypsum, the mortar strength is increased from 109 kg/cm.^{2} to 270 kg./cm.^{2} at the age of 7 days.
3) Lime-calc. clay-gypsum mixture (3:6:1) shows about 70 percent strength of commercial standard portland cement.
4) Pozzolan-portland cement, with 20 percent replacement of cement by the clay, gives as high strengths as the original portland cement.
5) By examining a lime-clay mixture with water under a microscope, two kinds of needle crystals were observed, which are to be regarded as hydrates of calcium aluminate and calcium sulfoaluminate.

From the results, the soluble or reactive alumina in calcined clay seems to react in hydrating, quite similar to $3CaO \cdot Al_2O_3$ in portland cement.

Chemical analysis of clay (calc. at 1400 deg. F.)

	Loss on ignition	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3
Total analysis	1.15	49.79	45.95	2.86	0.85	0.26	trace
Soluble analysis (boiled with 10 percent NaOH sol.)	1.15	45.00	44.47	1.63	0.85	0.24	trace

Chemical test by U.S. Bureau of Reclamation

	Alkali reduction (R)	Soluble SiO_2 (S)	Soluble Al_2O_3	R—2/3S
Kaolinite clay (raw)	650 mM/l.	10 mM/l.	87 mM/l.	657
Kaolinite clay (calc.)	500 mM/l.	10 mM/l.	166 mM/l.	507

Bibliography on Cement and Concrete

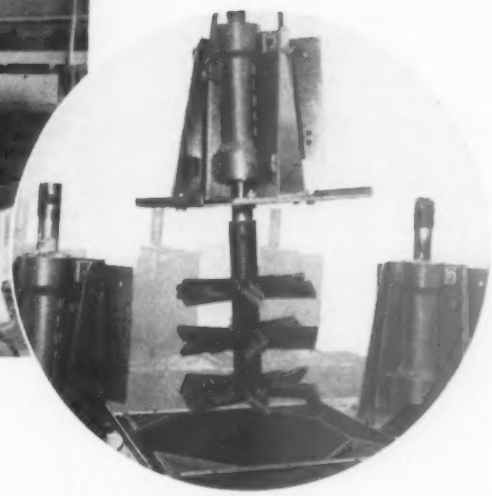
Comprehensive Bibliography of Cement and Concrete 1925-1947, by Floyd O. Slate, 491 pages, Engineering Experiment Station, Purdue University, Lafayette, Ind., $5.00.

THIS LITHOPRINTED BIBLIOGRAPHY contains more than 40,000 references on cement and concrete published during the period 1925-1947, including articles in both United States and foreign publications. The major subdivisions include such subjects as: cement, pozzolans, admixtures, aggregates, mortar and concrete coatings, reinforced concrete, architectural concrete, lightweight concrete, ready-mixed concrete, precast concrete, construction, and others.

Buys Interest in Quarry Firm

JOHN K. WESTFALL, widely known in the Kansas City area through his past association in an engineering and sales capacity with the Portland Cement Association, Lehigh Portland Cement Co. and, for the past seven years, with G. W. Van Keppel Co., Kansas City contractors' equipment firm, has purchased an interest in Gordon Quarries, Inc., Forest City, Mo. The company operates three crushed limestone quarries at Savannah, Maitland and Oregon, Mo., and is engaged in supplying agriultural limestone and road rock surfacing material in several northwestern Missouri counties. Substantial amounts of riprap are furnished on Missouri river projects in that area. Mr. Westfall has assumed general management of the company.

UNIVERSITY OF MICHIGAN LIBRARIES



Get Higher Recovery— Improved Quality— with the **WEMCO** *ATTRITION MACHINE*

Here is a **new** machine that gives you an economical—a **profitable** solution to two important problems:

1. *Efficient processing of ores and industrial sands having excessive surface coatings.*
2. *Liberation of cemented materials.*

If either of these problems exists in your operations, the WEMCO ATTRITION MACHINE will give you improved quality of your product or higher recovery at a given quality.

RECOVERIES INCREASED AS MUCH AS 3 TIMES!

- Actual pilot plant tests of attritioning on the retreatment of tungsten tailings improved recovery from 22% to 68%!
- Similar tests on reflotation of gold from rejects increased recovery from 20% to 65%!
- Glass sand recovery by flotation after attritioning increased from 80% to 95%!

The wide adaptability of the WEMCO Attrition Machine has been proved by actual plant operation and pilot plant tests. Here are a few examples of results obtained:

Tungsten ore—Substantial improvement of flotation grade and recovery in the retreatment of former tailings.

Uranium ores—Liberation of uranium minerals in the cementing material of sandstone.

Glass sand production—Removal of iron oxide stain to meet market specifications.

Aggregate and sand production—Disintegration of sand and clay cementing material from aggregate, saving both aggregate and sands for marketing.

Sulfide ores—Removal of semi-oxidized coatings, making possible flotation recovery—by removal of reagent and oxide coatings on former tailings.

PRINCIPLE OF OPERATION

By controlled turbulence of high density pulps, the WEMCO Attrition Machine thoroughly abrades mineral and ore particles. The imparted action is decidedly more efficient and complete than similar treatment previously attempted by other methods. Power consumption is greatly decreased, averaging 3½ to 7 kw. per ton of capacity. Maintenance and replacement costs are lowered to approximately 1 cent per ton of output.

APPLICATIONS

Treatment of Particle Surfaces

Removal of oxidized coatings
Elimination of slime coatings
Removal of reagent coatings
Surface polishing of particles

Liberation of Cemented Minerals

Ores and industrial minerals of this type may be separated, either the particles or the cementing material being recoverable for valuable mineral content.

Write today for full information on this new metallurgical tool and on WEMCO's facilities for conducting laboratory tests on your ore dressing or Sand preparation problem.

WEMCO
WESTERN MACHINERY COMPANY
760-766 FOLSOM STREET SAN FRANCISCO 7, CALIFORNIA

OTHER **WEMCO** PRODUCTS
Mobil-Mills • Coal Spirals • HMS Thickeners • HMS Pumps • Sand Pumps Cone Separators • Drum Separators • Fagergren Laboratory Units • Agitators Fagergren & Steffensen Flotation Machines • Hydroseparators • S-H Classifiers HMS Laboratory Units • Dewatering Spirals • Thickeners • Conditioners • Densifiers

Labor Relations Trends

(Continued from page 71)

of all production and maintenance employes; (c) in any other manner interfering with or coercing its employes in the exercise of the right to self-organization; and to take the following affirmative action: (a) offer to the 66 striking employes immediate and full reinstatement; (b) make whole such employes for any loss of pay they suffered by reason of Respondent's discrimination against them; (c) upon request bargain collectively with United Brick and Clay Workers of America, A.F.L., and (d) post appropriate notices in the plant."

The court agreed with the N.L.R.B., on all these findings, and on its petition for enforcement of its order, but the board had gone farther and passed on subsequent developments in connection with the strike in which some picketing was attended by violence and disorder. This led to interruption of work on a new building for the employer, and promotion by the plant strikers of what has been decided as a secondary boycott on the construction contractor. The board's findings in respect to this factor, which was that it was not a secondary boycott, is the subject of the separate court decision which follows (in substance).

Decision on Secondary Boycott

This case came to the Circuit Court of Appeals on appeal by the United Brick and Clay Workers of America and its co-defendant the A.F. of L. from a U.S. District Court decision awarding the employer, (the same already described above) damages amounting to $29,985.85, as the result of a jury trial. The damages were to the clay products company for losses from the allegedly illegal secondary boycott. The company had sued for a total of $243,605.52.

The facts in the case were as follows: In 1948 a general contractor had completed foundations for a new building at the clay products plant, but when the strike of the clay workers' union against their employer occurred and picket lines were established, sub-contractors for the steelwork were unable to get the steel unloaded or erected. Thus the employes of the general contractor and his subcontractors were induced to quit work, with the object of compelling the clay products company to deal with its striking employes. There were various legal technicalities involved which it is not necessary to go into here in much detail. The court's decision goes into the whole subject of secondary boycotts very thoroughly, reviewing many relevant decisions, and therefore should prove valuable to the legal profession. The case was unusual in that it was brought under Section 303 (a) and (b) of the L.M.R.A., while the N.L.R.B. ruling and most of the previous court decisions have been under another section of the act which describes a secondary boycott merely as an unfair labor practice. Section 303 (b) permits "whoever shall be injured" to sue in any U.S. District Court for damages sustained by such an illegal boycott.

According to the text of Court of Appeals decision: "The appellants [the labor unions] made a general denial of the material allegations of the complaint and also pleaded as a defense thereto (1) that the complaint failed to state a claim upon which relief could be granted; (2) that the District Court lacked jurisdiction, since diversity of citizenship as required for actions under Section 303 of the Labor Management Relations Act was not shown, and (3) that Section 303 of the Labor Management Relations Act, if construed as contended for by the company, was unconstitutional as being violative of the First and Fifth Amendments of the Constitution of the United States. The District Judge ruled that jurisdiction existed, that Section 303 of the Labor Management Relations Act was not unconstitutional, and, conditional upon the existence of certain facts, conferred a right of action for damages upon the company, and that the evidence produced was sufficient to submit such factional issues to the jury."

The Appeals Court sustained the District Court judge and ruled against the union on all points. The union attorneys, who represented some of the best legal talent in the A.F. of L., tried to make as an important point that the picketing did not surround the construction plot and was designed to keep out of the plant only the members of the clay workers' union and other plant employes. However, the exhibit of a map of the locality convinced the court that it was unnecessary to surround the plot to keep workers from access to the construction job. The court also concluded from all the evidence that the primary purpose of the picketing of the construction job, which occurred only when the subcontractor received steel or attempted erection, was to prevent the general construction contractor from doing business with the clay products company until it made a contract with its workers. The court also ruled out the union's contention that the actual picketing of the construction job was by the local teamsters' union which was having trouble with the general contractor.

The chief argument was over the meaning of the Section 303 (b) which confers the right of an injured party to sue a union for damages. The union lawyers contended that Congress meant to give this right only to neutral third parties, not to the employer directly involved in a primary dispute with his employes. On this point the court reasoned as follows, and its decision is important because so far as we know it is the first comprehensive one on this point. "They argue that it was the purpose of the Act to confer a right of action upon the neutral employer who, through no fault of his own and without being himself involved in any labor dispute, is damaged by the secondary pressure exerted against him by a union involved in a labor dispute with another employer. We are urged to disregard the literal meaning of the word 'whoever,' and give to it a restricted meaning which would be consistent with the purpose of the Act and effectuate the will of Congress. There is some legislative history of the Act indicating a desire to protect an innocent third-party employer, but we do not find evidence of an intent to restrict the protection against a secondary boycott to such a person.

"The secondary boycott was not illegal under the National Labor Relations Act as originally enacted. But Congress made it illegal by the enactment of the Labor Management Relations Act of 1947. In doing so it used the broad and inclusive language of 'Whoever shall be injured.' The legislative history shows that Congress was aware of the broad coverage provided by this phrase. If it had intended to limit the right of action to innocent third-party employers, it could easily have done so. If Congress considered the use of the secondary boycott in a labor dispute as unfair labor practice and illegal, as it did by the enactment of the Labor Management Relations Act of 1947, it was entirely consistent with such decision to give a right of action to anyone who was injured in his business by a violation of the law thereafter. Such a construction was given to analogous provisions of the Sherman Anti-Trust Act. We are of the opinion that in the present case the word 'whoever' has plain unambiguous meaning which we are not authorized to disregard, and as so construed it includes the appellee [the clay products company].

"Appellants further contend that Section 303 (a) (2) of the Act, Section 187(a) (2), Title 29 U.S.C., makes an exception to Section 303(a) (1) of the Act, Section 187(a) (1), Title 29 U.S.C., where a certified union applies secondary pressure to force recognition by the primary employer, and that their activities in this case fell within the exception. It is argued that the activity proscribed by Section 303(a) (2) is also included in Section 303 (a) (1), and that Section 303 (a) (2) is meaningless and unnecessary unless construed as an exception. Although there is some basis for such a construction of the two sections, we do not think that such was the intent of Congress. Such a construction would make the first part of Section 303(a) (2) a repetition of something already covered by Section 303(a) (1) and therefore unnecessary. Such a result could have been more orderly and naturally

UNIVERSITY OF MICHIGAN LIBRARIES

QUICK, EASY DISASSEMBLY MEANS

Low Service Cost

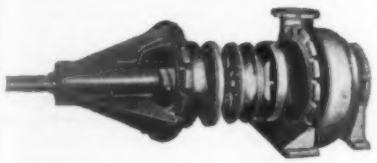
1. Disconnect drive, loosen casing bolts and lift bolt assembly from slot. Bolt, nut and washers are still connected for easy reassembly.

2. Swing out rotating element. Neither suction nor discharge piping is disturbed. All wearing parts are fully accessible for inspection or servicing.

Back in Service in less than a Half Hour

ALLIS-CHALMERS

Coal Washing Pump



Only 5 Wearing Parts

Shaft sleeve, impeller, casing, two wear plates. All easy to handle and easy to replace.

YOU CAN SEE for yourself how quick and easy it is to service an Allis-Chalmers Solids Handling Pump. Fast servicing like this plus long runs between servicing keeps your pumping costs low.

You get long life from Allis-Chalmers Coal Washing Pumps, too, because they are made of special hard *Allisite* alloy . . . because they have thick sections and heavy parts throughout . . . and because they are application engineered by specialists who know coal washing problems and how to solve them. Allis-Chalmers can supply the complete pumping unit — pump, motor, drive and control — of matched components from one reliable source with one guarantee of satisfaction.

Get complete information on Allis-Chalmers Solids Handling Pumps from your nearest Allis-Chalmers Authorized Distributor or District Office. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, asking for Bulletin 08B6381. A-3781

Allisite is an Allis-Chalmers trademark.

ALLIS-CHALMERS

American HAMMERMILLS
OFFER...
"ACS Series"
Made in 4 sizes and two types. Capacity to 250 T. P. H.
Front Feed — For minimum of fines.
Center Feed — For maximum of fines. (Illustrated at left)
...A Size for Every Tonnage
"30 Series"
Made in 4 sizes. Capacity up to 100 T.P.H.
...from Roadstone to Agstone
"24 Series"
Made in 4 sizes. Capacity up to 50 T. P. H.
Write for Bulletin—"Better Stone Crushing"
American PULVERIZER COMPANY
Originators and Manufacturers of Ring Crushers and Pulverizers
1245 Macklind Ave.
St. Louis 10, Mo.

obtained by combining the two sections into one section with the exception included. In enacting Section 303(a) Congress subdivided it into four separate paragraphs, each apparently pertaining to a separate field of labor activity. There is no express provision making any one paragraph a modification or limitation of the provisions of another. In two of the paragraphs, 303(a) (2) and (a) (4) Congress expressly excluded certain activities from their general scope by the use of the word 'unless.' There is no such exception included in the wording of paragraph (a) (1). Implied exceptions to the express provisions of a statute are not favored.

"We are of the opinion that Section 303(a) (2) pertains to a specific, restricted field of labor activity, not necessarily included in the provisions of Section 303(a) (1), but in any event withdrawn from its coverage for the purpose of being treated as a separate and independent field of labor activity, and that it is not to be treated as nullifying the effect of other activities of labor organizations proscribed by Section 303(a) (1). The action of the District Judge in submitting the case to the jury under the provisions of Section 303(a) (1) only, without regard for the provisions of Section 303(a) (2) was, in our opinion, correct.

"The judgment is affirmed."

So that readers may see the points about section 303, covered by the ruling, the relevant parts are given herewith:

(a) It shall be unlawful * * * for any labor organization to engage in, or to induce or encourage the employes of any employer to engage in, a strike or a concerted refusal in the course of their employment to * * * work on any goods * * * or to perform any services, where an object thereof is—

(1) forcing or requiring any employer * * * to cease using * * * or otherwise dealing in the products of any other producer * * * or to cease doing business with any other person;

(2) forcing or requiring any other employer to recognize or bargain with a labor organization as the representative of his employes unless such labor organization has been certified as the representative of such employes * * *;

(3) forcing or requiring any employer to recognize or bargain with a particular labor organization * * *;

(4) forcing or requiring any employer to assign particular work to employes in a particular labor organization * * *;

(b) Whoever shall be injured in his business or property by reason of any violation of sub-section (a) of this section may sue therefore in any district court of the United States without respect to the amount in controversy, or in any other court having jurisdiction of the parties, and shall recover the damages by him sustained and the cost of the suit.

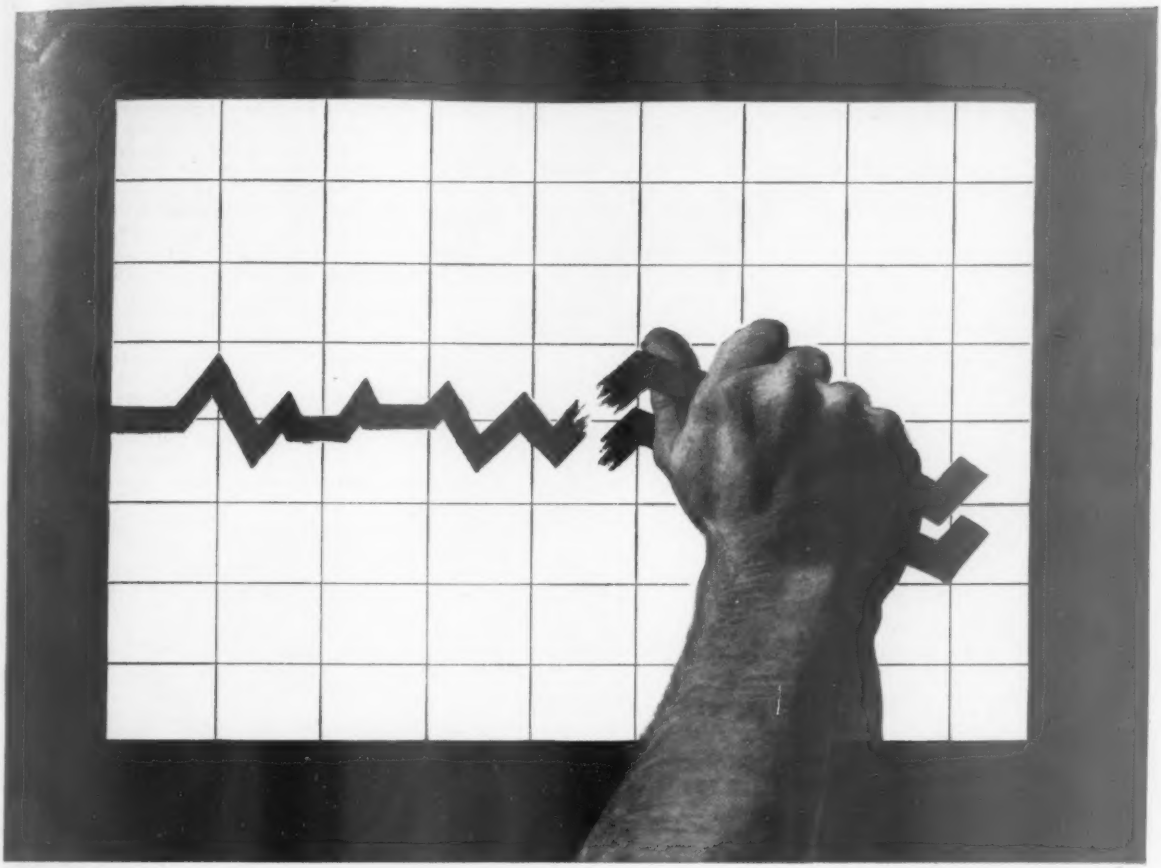
New Mica Process

MOSES D. HEYMAN, Woodmere, L.I., N.Y., a former mica trader, has developed a new process to make mica strips from mica waste and synthetic mica supplied by the Bureau of Mines. The strips can be made over 50 ft. in length with thicknesses up to ⅛ in.

Gypsum Survey

GEOLOGISTS FROM THE STATE and federal geological surveys are planning to study the gypsum deposits in Marshall county, Kan.

UNIVERSITY OF MICHIGAN LIBRARIES



Irreplaceable...production lost in idle kilns!

You can cut down on hot zone replacements in rotary cement kilns which steal precious production time when you install Permanente Periclase-Chrome refractory bricks.

That's because patented Permanente Periclase-Chrome bricks are *especially designed* for hot zone linings in cement kilns.

With Permanente Periclase-Chrome bricks you get a lining of maximum refractoriness that is highly resistant to chemical attack by cement clinker. They take a good coating, hold it well, and have great resistance to thermal shock.

Verified performance records show that Permanente Periclase-Chrome bricks have withstood as many as *17 shutdowns* for various causes *without any loss of brick due to spalling.*

If you feel that an appraisal of your rotary kiln performance would be helpful, Kaiser Chemicals will be glad to work with you. Installation assistance also is available at no extra cost.

Standard brick sizes supplied in both burned and chemically bonded forms. Recently expanded facilities insure superior service. Call or write principal sales offices: *Chemical Division*, Kaiser Aluminum & Chemical Sales, Inc., 1924 Broadway, Oakland 12, California. First National Tower, Akron 8, Ohio.

Kaiser Chemicals

Pioneers in Modern Basic Refractories

Basic Refractory Brick and Ramming Materials • Dolomite • Magnesia • Magnesite • Alumina • Periclase

Stearns ELECTRO-MAGNETIC PULLEY PROTECTS REDUCTION CRUSHERS

"pays for itself over and over"

HANDLING limestone for a large mid-western producer, this STEARNS Electro-Magnetic Pulley protects the reduction crushers by removing all tramp iron automatically, economically. If you want to reduce shut-down time and keep repair charges to a minimum — install a STEARNS Magnetic Pulley. It's the only economical and effective insurance against the tramp iron nuisance.

Whether your problem is the fairly simple job of tramp iron removal or the concentration and beneficiation of complex ores, STEARNS has EXPERIENCE ENGINEERED equipment to meet your specifications.

For a thorough investigation of your separation problem, STEARNS offers complete laboratory research facilities. Write today for details on testing of sample material.

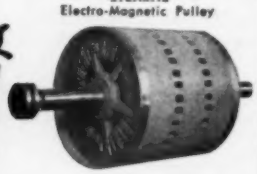
ALL SIZES, ALL TYPES TO FIT YOUR NEEDS

Years of research and development by STEARNS engineers have produced an outstanding product in magnetic pulleys — the reason for the wide acceptance in all industries for removing tramp iron, for separation and reclamation of materials. For complete specifications and operating data, write for literature.

STEARNS Permanent Magnetic Pulley

Stearns ELECTRO AND PERMANENT MAGNETIC PULLEYS

STEARNS Electro-Magnetic Pulley



Foremost in the Magnetic Field

Stearns MAGNETIC INC.

675 South 28th Street, Milwaukee 46, Wisconsin

Rocky's Notes

(Continued from page 69)

have been encouraged to believe that their government can rewrite the natural laws of economics, and that spending, regardless of motives, or the products purchased, makes national prosperity. We have not had a responsible statesman or politician, with very few exceptions, who had the moral courage to tell the people the facts of economic life. The people have, instead, been encouraged to believe that more paper dollars for less work *is* prosperity itself. But prosperity, individual or national, has never been attained by exhausting irreplaceable resources, the values of which are measured in a depreciating paper currency or by labor and services expended in producing ultimately wasted assets. Such "prosperity" is actually a sacrifice of irredeemable material values both at our own expense and at the expense of generations of Americans yet to come. If it gains us compensating spiritual values, it might be worth the cost. Who knows?

Liming Materials

(Continued from page 92)

been used in Missouri, billboards extolling liming are used in Iowa, and many state educational and promotional associations have been formed for this purpose. Such sales efforts eight to ten years ago would hardly have been considered likely for such a traditionally low cost commodity.

This is a healthful sign since there is always a strong chance that the present P.M.A. activities could be greatly curtailed. Or even if the soil conservation funds are not cut or eliminated, there is no guarantee that liming materials will continue to receive as much of the P.M.A. funds or attention as they have in the past ten years. From a practical standpoint, liming is simply one of 130 services offered to the farmer by the P.M.A., consequently it has considerable competition. In 1950, phosphates, for example, received a greater proportion of P.M.A. funds, amounting to 19 percent as against 16 percent for lime and limestone. There have been strong indications from the P.M.A. that some of the funds currently used for liming will be diverted to other soil conservation practices in the near future. Consequently, the industry will have to intensify its growing sales and educational efforts in behalf of liming even to hold its present market—let alone make progress toward the 55,000,000 ton market.

Potash Company to Open

SOUTHWEST POTASH CO., Carlsbad, N.M., is planning to start production of asbestos this fall in the Artesia-Carlsbad area.

UNIVERSITY OF MICHIGAN LIBRARIES

Tunnel to China

"Dig deep enough and you'll reach China."

Youngsters learn best through their own experience.

A good way, but costly.

The experience of others can be as valuable. And more economical of time, materials and motions.

Certainly this is true of packaging. Do you use or contemplate using Multiwall bags? You will find it worthwhile to draw upon the combined experience of Union's Multiwall packaging specialists. They have worked successfully with Multiwall users in hundreds of industries. Chances are they can help you.

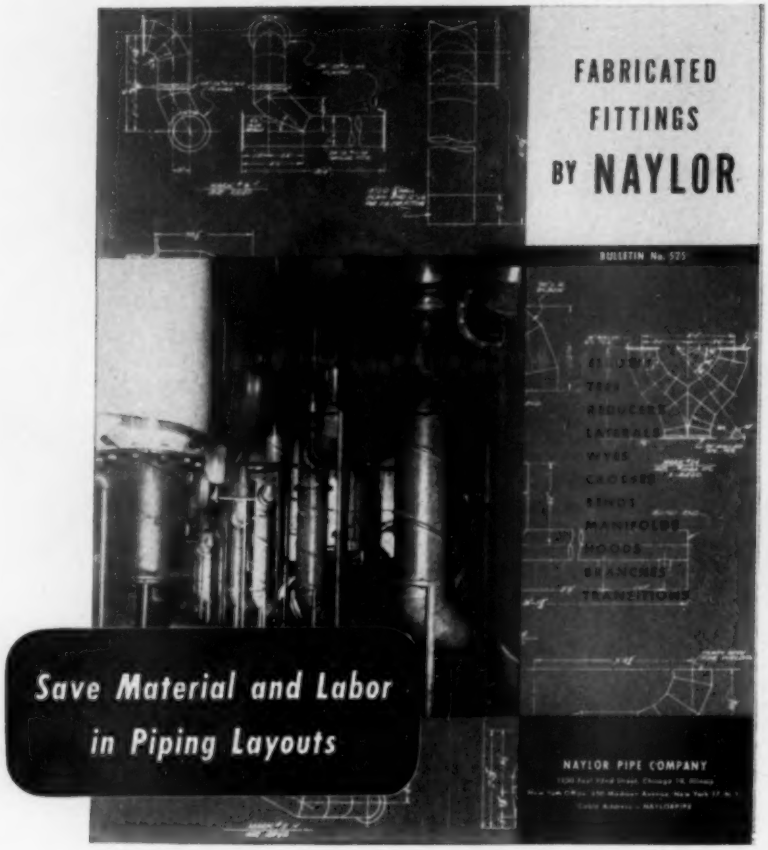
More so every day . . .

IT'S UNION FOR MULTIWALLS

TRADE MARK UNION

UNION BAG & PAPER CORPORATION • NEW YORK: WOOLWORTH BUILDING • CHICAGO: DAILY NEWS BUILDING

Get this GUIDE to FABRICATED FITTINGS



Write for this helpful bulletin on Naylor Fabrication Service. It presents data on standard and special fittings for lightweight pipe and offers practical ideas to simplify piping layouts. Included are special fabrications to save time, material and labor through eliminating numerous flanged joints and combining many fittings into one integral unit. Ask for Bulletin No. 525.

NAYLOR PIPE

Naylor Pipe Company
1237 E. 92nd St., Chicago 19, Ill.
New York Office:
350 Madison Ave., New York 17, N.Y.

Canadian Gravel Plant

(Continued from page 95)

The company recognizes the changing trend in aggregates and is determined to supply a clean specification material at all times. In the development of the plant, special attention has been paid to head room and side clearances, in order to provide adequate and safe storage and working space. It is intended that safety, cleanliness and good housekeeping shall be outstanding characteristics of the plant.

Sand production and screen analysis have been given a great deal of study. While the sand presently being produced is of very excellent quality, provision has been made to blend in an additive sand if necessary. A very good grade of sand is available on the property for blending purposes.

Planning and direction of construction has been under the personal direction of G. G. Robinson, president and manager of Consolidated Sand and Gravel Limited. Operation of the plant is directed by J. M. Kincaid, superintendent, assisted by G. K. Shirton.

Foreign Cement Production

CHILE: Cement production for the first nine months of 1951 totaled 380,258 metric tons, produced by two plants. The output for 1952 is expected to reach 800,000 tons. Due to the increased domestic production, the export ban was recently lifted and shipments have been resumed to other South American countries. The Minister of Economy has authorized cement exports up to 100,000 tons for 1952. A new slag-cement plant is now under construction.

CANADA: Cement production in 1951 totaled 16,927,607 bbl., compared with 16,741,826 bbl. produced in 1950. Imports in 1951 amounted to 2,327,431 bbl., while exports were listed at 2590 bbl. This compares with 1,386,216 bbl. imported in 1950 and an exportation of 23,910 bbl. Most of the exports were to the United Kingdom and to Brazil.

These reports were taken from *Mineral Trade Notes*, May, 1952, issue, published by the Bureau of Mines.

Granted Certificate

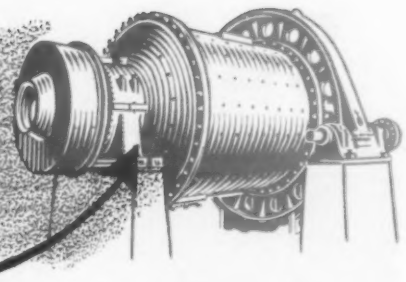
THE KELLEY ISLAND LIME & TRANSPORT CO., Cleveland, Ohio, has been granted a certificate by the Defense Production Administration, entitling it to a 20 percent rapid tax write-off on an $8,300,000 limestone project in Presque Isle county, Mich.

Buys Stock

AMERICAN ENCAUSTIC TILING CO., INC., recently purchased 85 percent of the stock of United Feldspar & Minerals Corp. The acquisition was through a subsidiary, General Mills Co.

UNIVERSITY OF MICHIGAN LIBRARIES

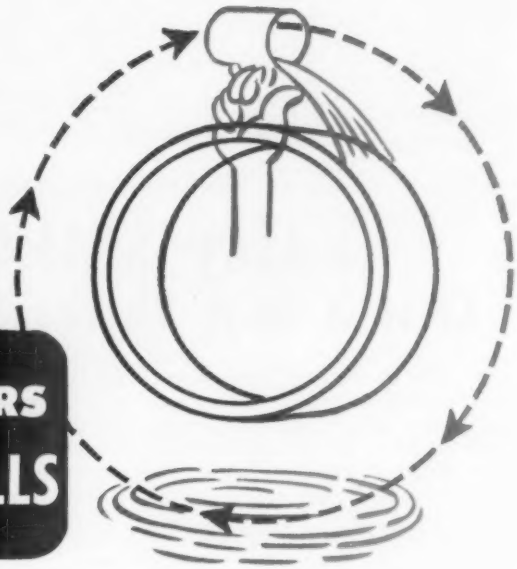
"Inside Story"



of Allis-Chalmers Oil Lubricated Trunnion Bearing...

AN OILING BUCKET inside this Allis-Chalmers trunnion bearing revolves with the trunnion . . . lifts oil from the reservoir in the bottom of the bearing housing to an oil distributing pan above the bearing. From here it floods down onto the bearing, lubricating the full face of the bearing uniformly and continuously.

You'll always have the comforting assurance that the all-important trunnion bearing on your mill is being dependably lubricated. This assured protection of internal lubrication is standard on all Allis-Chalmers oil lubricated bearings — even on installations where a separate external oiling system is used. A-3722



ALLIS-CHALMERS
GRINDING MILLS

These protective features of A-C trunnion bearings also give you savings in power and maintenance —

- ★ An improved seal keeps dirt out of oil and has been designed to provide for mill expansion.
- ★ A hand operated, high pressure lubricant pump "floats" the mill after shut-down . . . eliminates dry starting.
- ★ If desired, an external system for filtering and cooling can be added to the internal oiling system.

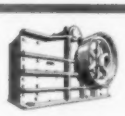
Get more facts from the Allis-Chalmers representative in your area, or write for Bulletin 07B6718A. Allis-Chalmers, Milwaukee 1, Wis.

ALLIS-CHALMERS

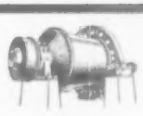
Sales Offices in Principal Cities in the U. S. A. Distributors Throughout the World.

Hammermills

Vibrating Screens

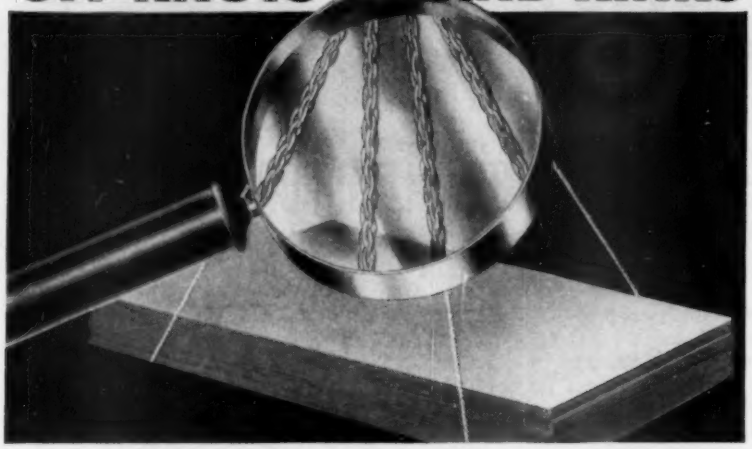

Jaw Crushers

Gyratory Crushers


Grinding Mills

Kilns, Coolers, Dryers

Tuffy® Fights OFF KNOTS AND KINKS



That's One Reason Users Report:

"Tuffy® SLINGS Last 3 to 4 Times Longer"

Only Tuffy has the new, braided fabric construction that (1) fights off knots and kinks, yet (2) can take much more stresses of distortion than ordinary wire rope. It means big savings in time, costs and delays on the job.

To make Tuffy Slings, scores of wires are stranded into 9 parts, then machine-woven into an interlaced wire fabric that has greater flexibility, extra safety and strength. Send for a *free* 3-ft. sample of Tuffy Sling fabric and test it yourself.

Proof-Tested For Safety. Each of the 12 types of Tuffy Slings is proof-tested to twice its safe working load. You'll find the working load figure on the metal eye splice sleeve. It's your assurance of a safe, longer-lasting sling.

Get The ONLY Sling Handbook of its Kind FREE

See how you can cut sling costs up to 40% or more through proper care and handling of slings. Most-talked-about book on slings ever published!

Mail Coupon TODAY!

UNION WIRE ROPE CORP

UNION WIRE ROPE CORPORATION
Specialists in Wire Rope
2156 Manchester Ave. Kansas City 3, Mo.

☐ Send FREE Tuffy Sling Handbook and Rigger's Manual.

☐ Have My Union Wire Rope Fieldman deliver me a FREE 3-Ft. sample Tuffy Sling.

FIRM NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Sinter-Grate Kilns

(Continued from page 104)

Tensile strength values for two tests:

	Test 1	Test 2
After 7 days	57 kg./sq. cm.	57 kg./sq. cm.
After 28 days	74 kg./sq. cm.	73 kg./sq. cm.

Compressive strength values

After 7 days	277 kg./sq. cm. 265 kg./sq. cm.
After 28 days	422 kg./sq. cm. 434 kg./sq. cm.

General Remarks

A survey of the differences in the burning of raw mix and raw slurry in known kiln burning systems shows that the most favorable thermal process and the most flexible clinker producing process has not been developed yet.

The sinter band kiln process provides a means of being able to burn raw slurry without any special requirements, because of simultaneous burning of return material with the slurry mix.

The use of a portion of the hot waste gases makes possible the burning of raw slurry with a thermal consumption of about 1400-1450 cal./kg. of clinker.

It is possible to produce about 8 tons of clinker from raw slurry on 1 sq. m. of the suction grate surface area.

No quality differences exist between rotary kiln and sinter band kiln clinker produced from the same raw slurry material.

Literature Cited

1. Anselm, W., "Die Zementherstellung," Berlin (1941).
2. Anselm, W., "Die Schnellkuehlung des Klinkers bei Zementbrennoefen," *Zement-Kalk-Gips*, Vol. 2, page 84.
3. Boerner, K., and Kirste, R., "Betriebserfahrungen ueber das Zementbrennen auf dem Sinterrost," *Zement-Kalk-Gips*, 1948.
4. Wendeborn, H., "Das Lurgi Zementbrennverfahren," *Zement-Kalk-Gips*, Vol. 2, No. 1.
5. Wendeborn, H., "Saugzug Sintern und Roesten," *VDI Verlag*, 1934.
6. Wendeborn, H., "Das Saugzugsinterverfahren und seine Verwendung beim Zementbrennen," *Zeitschrift VDI*, Vol. 79, page 541 (1935).
7. German patents Nos. 609,839; 700,791, and 721,117.

Fatty Acids

M. P. Doss, technical librarian of The Texas Co., has published a survey titled "Properties of the Principal Fats, Fatty Oils, Waxes, Fatty Acids and Their Salts." In its 244 pages, the new publication covers the properties of approximately 50 of the principal fats, fatty oils, and waxes. Mr. Doss surveys only aliphatic acids, but he tabulates the properties of more than 800 of these. The unique part of the book is the data given on the salts of the fatty acids ranging from aluminum through zirconium. Approximately 1750 salts are listed. The book concludes with a variety of pertinent conversion tables (i.e., temperature, gravity, viscosity, color) and a detailed subject index. It is now available for purchase from the Technical and Research Division of The Texas Company, 135 E. 42nd St., New York 17, N.Y. The price is $5.00.

UNIVERSITY OF MICHIGAN LIBRARIES

Another new SECO?

Yes 2,000,000 tons ago!

***IN SERVICE OF SCOTT COUNTY STONE COMPANY, INDIANA**

SECO

TRUE CIRCULAR ACTION

VIBRATING SCREENS

THIS 13 YEAR OLD SECO WORKHORSE JUST FACTORY REBUILT

. . . Ready For Another Stretch of Service

After 13 years of big tonnage service, (200,000 tons last year alone) this 4′ x 16′ Seco vibrating screen was returned to the Seco factory for rebuilding. In 13 years of service, *not even one bearing was replaced!*

Here you see it before it was shipped back to Scott County Stone Company for more years of "front line service" with seven other Seco vibrating screens for this successful and well known firm.

After all, it's performance that counts and this is another example of Seco dependability on-the-job!

Put Seco vibrating screens on your job for smooth operation, top tonnages and a minimum of maintenance. Send for Catalog #203 today!

PUT A DEPENDABLE SECO SCREEN ON YOUR JOB

Seco builds over 300 models in single, double, triple and three and one-half decks. Models for every aggregate screening job. Send us your problem. No obligation.

SCREEN EQUIPMENT CO. INC.

1750 Walden Avenue, Buffalo 25, N.Y.

In Canada: United Steel Corp., Toronto, Ontario

MAXI-MOUNTED

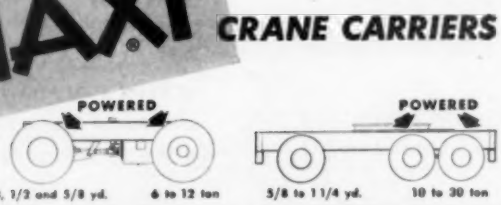
WITH THESE MAXIMUM ADVANTAGES

one-man control
operation stability through 360°
close quarter maneuverability
fast travel—either direction

Adaptable for all makes of cranes from 5 to 50-ton capacity.

Write for additional information.

MAXI® CRANE CARRIERS



MANUFACTURED BY SIX WHEELS, INC. • LOS ANGELES 54, CALIF.

A.I.M.E. Meeting

(Continued from page 120)

by the Indiana Geological Survey, took in plants of the Crisman Sand Co., Manley Sand Co. and the Bos Sand Co. (all foundry sand plants) and the Indiana Dune Sand State Park for a study of unusual geologic features. The second trip, conducted by the Illinois Geological Survey, took the group to the plant of Standard Silica Corp. at Ottawa, Ill., and to the plant of Illinois Clay Products Co. at Goose Lake, near Joliet, Ill.

Thermal Properties of Concrete

THE RESEARCH LABORATORY, operated jointly by the National Sand and Gravel Association and the National Ready Mixed Concrete Association at the University of Maryland, continues to conduct large numbers of miscellaneous investigations concerned with special problems of member companies, as well as carrying out its normal research program.

One investigation recently completed dealt with studies of the thermal properties of concrete and concrete aggregates. The results of this study were recently reported in the *Journal of the American Concrete Institute*, which has been reprinted in booklet form by N.S.G.A. and N.R.M.C.A. The paper, "Effects of Temperature Changes on Concrete as Influenced by Aggregates," is based on work done by W. G. Mullen while attending the University of Maryland on the Stephen Stepanian Fellowship of the National Ready Mixed Concrete Association. The paper deals with the influence of the aggregate on the thermal properties of concrete, showing that quick changes in temperature are destructive to concrete and that the thermal coefficient of the aggregates influences the degree and rate of destruction. However, it was stated that there was no evidence that differences between thermal coefficients of the coarse aggregate and mortar significantly affected the results. Also, changes in temperature at rates likely to be encountered in practice were found not to be destructive.

Plant Destroyed by Fire

NEW CASTLE LIME & STONE CO.'s Hillsville, Penn., plant was recently destroyed by a fire believed to have been caused by the explosion of an electrical transformer. Damage was estimated at $250,000 to $300,000. The plant produced agricultural limestone and mine dust.

Fluorspar Mill

KAISER CO. has begun construction of its fluorspar mill at Fallon, Nev. The mill is expected to cost $417,000. When completed it will process material from a wide area in central Nevada.

UNIVERSITY OF MICHIGAN LIBRARIES

OR TOUGH TONNAGE

Homocord CONVEYOR BELT

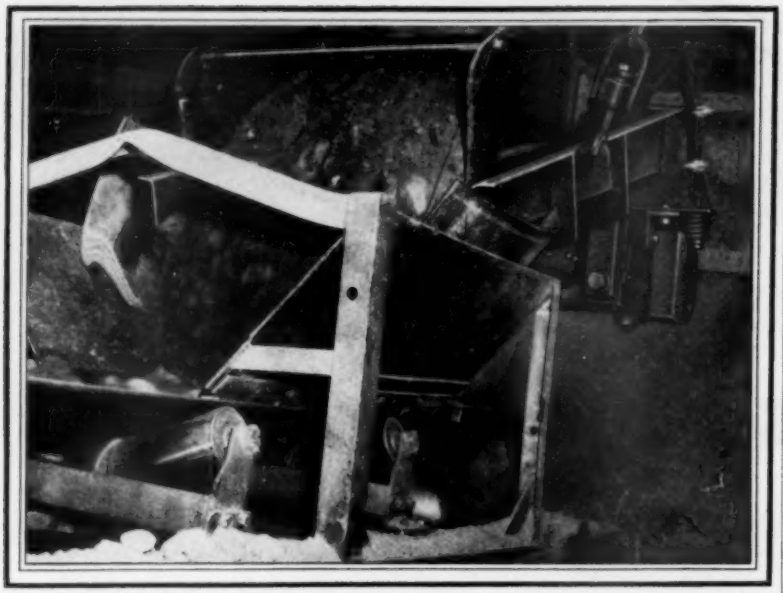
"We pay more for Homocord, but it costs us less!" • That's what users say . . . and they won't take any other conveyor belt. It makes sense, too. Where tonnage is toughest, Homocord has been known to outlast 2 or 3 ordinary conveyor belts. Figure cost of belts, plus cost of repeated installations, and Homocord proves the biggest bargain you can get • Its special construction—cushioned and flexible—absorbs impact that other belts can't take. Send for Bulletin 6906 and read about the Guillotine Test that proves our point • The same engineering goes into our hose, V-belts and flat belts. Get your Manhattan representative to show you.

R/M

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Packings • Brake Linings • Brake Blocks Clutch Facings • Asbestos Textiles • Sintered Metal Parts • Bowling Balls

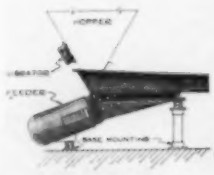


Model F-45 Syntron Vibratory Feeder handling 250 tons per hour of pit run gravel as a primary charging system to a rock plant.

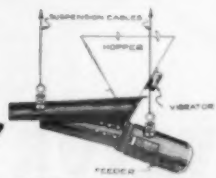
Adaptable To Your Needs

Handle Most All Types Of Bulk Materials

ROCK, SAND, LIMESTONE, ETC.—
HOT OR COLD—
DRY OR DAMP



SYNTRON
"VIBRA-FLOW"



BASE MOUNTING — SUSPENSION MOUNTING

VIBRATORY FEEDERS

The adaptability of Syntron Feeders to your present processing system with minimum change, makes them more than ever the answer to your problems.

Featuring instant control of rate of flow, from pounds to hundreds of tons per hour, Syntron Feeders assure more efficient handling of materials in your processing system. Flexibility in handling most bulk materials allows various applications of Syntron Feeders to your material handling system.

There is a type and model Syntron Feeder for each of your problems or needs. The variety of sizes and styles ranges from Light Tonnage Feeders with capacities from one to ten tons per hour to Heavy Tonnage Feeders with capacities up to hundreds of tons per hour, with flat pan, tubular, grizzly, screening and many other types of troughs.

Catalog data is available upon request.

Send us the details of your problem — description of material to be fed, maximum feed per hour, desired length of trough, etc. — our Engineering Department will be glad to submit their recommendations.

TUBULAR — GRIZZLY — LONG CONVEYOR — FLAT PAN

SYNTRON COMPANY
450 Lexington Avenue — Homer City, Penna.

N.L.A. Safety Competition

CERTIFICATES OF HONOR were awarded by the National Lime Association to 12 lime plants enrolled in the 1951 National Lime Association Safety Competition, conducted by the Bureau of Mines, for completing the year without a lost-time injury. These 12 plants worked an aggregate of 1,713,225 man-hours, or 16 percent of the total man-hours worked at the 47 competing plants.

A total of 10,932,408 man-hours was worked at the enrolled plants in 1951. The accident frequency rate of 22.776 injuries per million man-hours of operation, and the injury-severity rate of 3.091 days lost per thousand man-hours of work, were lower than the 1950 respective rates of 26.076 and 3.566. Both rates were lower than the 17-year average rates since the start of the competition in 1935.

The plants with injury-free records, listed according to their group classification, are:

Quarries with calcining plants working 100,000 or more man-hours

Natividad plant, Salinas, Calif., operated by Kaiser Aluminum and Chemical Corp., for 297,149 man-hours.
Luckey plant, Luckey, Ohio, operated by National Gypsum Co., for 214,360 man-hours.
Knoxville plant, Knoxville, Tenn., operated by The Standard Lime and Stone Co., for 113,909 man-hours.

Quarries with calcining plants working less than 100,000 man-hours

Thomasville plant, Thomasville, Penn., operated by The J. E. Baker Co., for 75,400 man-hours.
McCoy plant, Norristown, Penn., operated by Warner Co., for 67,880 man-hours.
Valders plant, Valders, Wis., operated by Valders Lime and Stone Co., for 39,915 man-hours.
Ripplemead plant, Ripplemead, Va., operated by Ripplemead Lime Co., Inc., for 37,437 man-hours.
Frederick plant, Frederick, Md., operated by Shank and Etzler Lime Co., for 11,555 man-hours.

Underground mines with calcining plants

Bell plant, Bellefonte, Penn., operated by Warner Co., Bellefonte Division, for 636,543 man-hours.
Quincey plant, Quincey, Ill., operated by Menke Stone and Lime Co., for 49,280 man-hours.

Calcining plants only

Buffalo plant, Buffalo, N.Y., operated by The Kelley Island Lime and Transport Co., for 91,252 man-hours.
Springfield plant, Springfield, Mo., operated by Ash Grove Lime and Portland Cement Co., for 78,545 man-hours.

N.S.G.A. Safety Competition

THE VAN SCIVER PLANT of Warner Co., Tullytown, Penn., the Hudson plant of Gifford-Hill and Co., Inc., Hearne, Texas, and Plant 7A of Lyman-Richey Sand and Gravel Corp., La Platte, Neb., were winners in their respective groups of the 1951 National Sand and Gravel Association Safety Competition. In recognition of their outstanding safety records, these operations will be awarded symbolic trophies, provided by ROCK PRODUCTS. Certificates of Achievement in Safety were also awarded to the winning plants by the association. Certificates of Accomplishment in Safety were awarded to the individual employes

UNIVERSITY OF MICHIGAN LIBRARIES

★ HERE IS WHERE STERLING-WHITE *Plan-A-Power* Really Pays Off!

★ **HERE**—Two full shifts per day, lots of heavy work under the shovel... Sterling-White flexibility and ease of maneuvering are mighty important. Steep grades handled easily with full load. Plan-A-Power does it!

★ **HERE**—Sterling-White can take it... day after day! Super-Traction differential means no bogging down on toughest road and load conditions.

WANT to step up schedules? Cut maintenance cost? Substantially reduce tire wear?

You can do it with Sterling-White Plan-A-Power!

Based on the cost records of leaders in construction industries, Sterling-White pays off every day . . . for more years. Engineered to exact work conditions, Sterlings can take it . . . can cut costs . . . can do more work.

Ask your Sterling-White Representative to provide facts about Sterling-White economy tailored right to your operations.

Sterling White

See your nearest STERLING-WHITE Representative

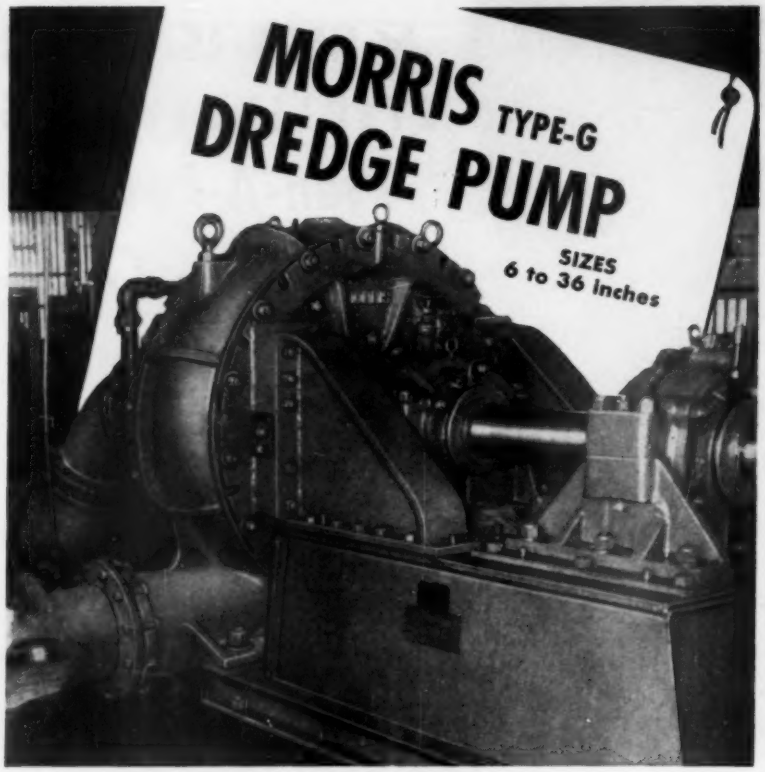
STERLING DIVISION

THE WHITE MOTOR COMPANY · ***Milwaukee 1, Wisconsin***

The White Motor Company of Canada Limited—Montreal
Export Department—Cleveland 1, Ohio, U. S. A.

Get More Work Done with Sterling-White Plan-A-Power

No more poor traction! Wheel spinning and slippage are reduced to a minimum with Sterling-White Plan-A-Power. Job-engineered super-traction differential divides power to each rear wheel exactly as road and load conditions demand. Sterling-Whites have the rugged design and plenty of power to MOVE and to LAST!



Your ticket to a

LONG RUN PERFORMANCE

with Minimum Power Consumption

What do we all want most in a dredge or materials handling pump? There is only one answer — *the lowest possible overall cost per yard or ton.* You've got it in the new Morris Type G. Intervals of down-time are few — because Type G is simple, rugged, fool-proof. Power consumption is cut to the bone, over a large range of capacities — through long or short pipe lines — against high heads or low. You'll be amazed at the performance of this new Morris Dredge Pump — but take a look at these design and construction features and you'll know why this "work horse" is being called "the most efficient dredge pump ever built."

1. **Runs maximum length of time under high, sustained output—without replacements. That means LESS DOWN-TIME.**
2. **Designed with fewest possible wearing parts—and these have longer life. That means LESS DOWN-TIME.**
3. **No complicated seals or sealing rings—less vulnerable points. That means LESS DOWN-TIME.**
4. **Unusually easy to dismantle, and reassemble. That means LESS DOWN-TIME.**
5. **Has Morris exclusive balanced impeller—less thrust—longer bearing life. That means LESS DOWN-TIME.**

Write today for detailed literature about this New Morris Type G Dredge Pump

MORRIS MACHINE WORKS
Baldwinsville, N. Y.

MORRIS *Centrifugal Pumps*

Branch Offices in Principal Cities

of these plants. N.S.G.A. also awarded Certificates of Achievement to all operations which operated 20,000 or more man-hours during 1951 without a lost-time injury.

The Van Sciver plant, winner of the group working more than 100,000 man-hours, operated 485,977 man-hours without a disabling injury. This plant has been a participant in 22 of the 23 competitions of the association and has won trophies in 1931, 1932, 1933, 1934, 1935, 1939 and 1949. During the 22 years of its participation, it has established a frequency rate of 6.401 injuries per million man-hours and a severity rate of 1.858 days per thousand man-hours of work.

The Hudson plant, with a record of 97,000 man-hours of operation without a lost-time injury, was the winner of the group working 50,001-100,000 man-hours. During the three years of its participation in the safety competition, this plant has worked a total of 251,866 man-hours without a disabling injury.

Plant 7A of Lyman-Richey Sand and Gravel Corp. worked a total of 44,646 man-hours in 1951 without a disabling injury and was the winner of the group working 50,000 or less man-hours.

A record number of 122 sand and gravel plants was enrolled in the 1951 competition. During a total worktime of nearly 9,000,000 man-hours, the largest volume in the 23-year history of the competition, there were 229 lost-time injuries. For the first year since 1945, the industry did not have a fatality. Of the 229 disabling injuries, six were permanent partial disabilities and the remainder temporary total disabilities. The injury severity rate was 1.428 days lost per thousand man-hours of operation, and the injury frequency rate was 25.888 per million man-hours. Both rates were well below the average rates for the history of the competition.

Of the 122 plants participating, 43 had perfect safety records for 1951. Men at these operations worked an aggregate of 2,387,891 man-hours, or 27 percent of all hours worked at the competing plants. The following plants, excluding the trophy winners, were awarded Certificates of Achievement in Safety for their accident-free records. In addition, there were 13 injury-free plants which did not receive certificates because they did not fulfill the minimum requirement of 20,000 or more man-hours of operation through the year.

Gifford dry-wet-pit plant, Gifford-Hill & Co., Inc., Minden, La.—149,808 man-hours.
Memphis dredge plant, Marquette Cement Manufacturing Co., Memphis, Tenn.—136,750 man-hours.
Dredge "Franklin" plant, Warner Co., Tullytown, Penn.—122,907 man-hours.
Roscoe No. 2 dry-pit plant, Consolidated Rock Products Co., Sun Valley, Calif.—116,687 man-hours.
Quigley wet-pit plant, Gravel Mining Co., Hurst, Texas—109,224 man-hours.
Phoenix dredge plant, Arizona Sand & Rock Co., Phoenix, Ariz.—105,847 man-hours.
Centerville No. 106 dry-wet-pit plant, Pacific Coast Aggregates, Inc., Centerville, Calif.—82,011 man-hours.

UNIVERSITY OF MICHIGAN LIBRARIES

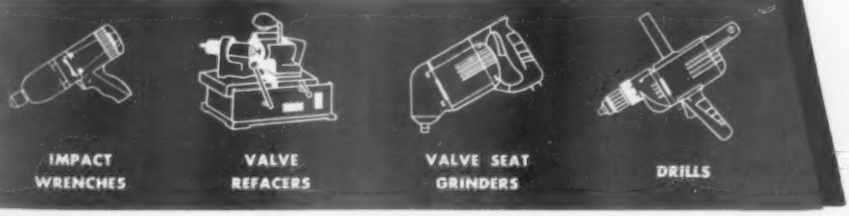
MAINTAIN YOUR EQUIPMENT WITH ELECTRIC and PNEUMATIC

Thor TOOLS

Thor 1¼" AIR IMPACT WRENCH speeds equipment overhaul jobs.

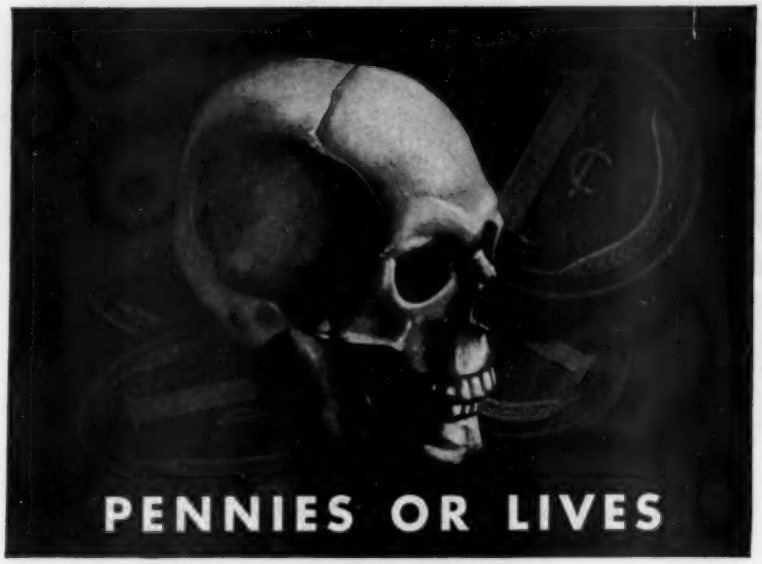
FOR THE REALLY ROUGH JOBS in your Repair Shop — loosening frozen and rusted nuts, working tough machine steel, and the like — give your mechanics THOR power tools, air or electric. You'll find rugged THOR tools speed the whole repair cycle, saving their initial cost many times over in short periods of time. Write for THOR Electric and Pneumatic Catalogs, listing scores of time-and-money saving power tools for the Repair Shop. Independent Pneumatic Tool Co., Aurora, Ill. Branches in 20 principal cities.

SEND FOR THESE TOOL CATALOGS!



SERVICE YOUR EQUIPMENT WITH Thor

THE TOOLS THE MANUFACTURERS USE!



Behind many industrial accidents is the ghost of equipment failure, often caused by skimping on quality in favor of a few cents saved.

Such economies are always risky, always more costly in the end.

But when you use Laughlin Safety Hooks (and there are 15 sizes in eye, shank and swivel patterns) the extra pennies you spend will pay big dividends in protection of men and equipment.

The latch locks the load. It cannot open until released by the operator. And it's made of pressed steel or bronze with a stainless steel spring that won't rust or weaken. The cam is an integral part of the hook forging for extra strength.

The quality construction of Laughlin Safety Hooks is typical of all of Laughlin's 1500 types and sizes of drop forged wire rope and chain fittings. So remember—to save with safety always insist on the name LAUGHLIN for original equipment or replacement fittings.

Our Catalog No. 150 shows and describes the complete line. A free copy will be sent on request.

THE THOMAS LAUGHLIN CO.

108 FORE ST., PORTLAND, MAINE

LAUGHLIN

THE MOST COMPLETE LINE OF WIRE ROPE AND CHAIN FITTINGS

Whitemarsh wet-pit plant, Harry T. Campbell Sons' Corp., Whitemarsh, Md.—76,076 man-hours.
Snelling Avenue dry-pit plant, J. L. Shiely Co., St. Paul, Minn.—62,801 man-hours.
Nos. 12, 13, 14 dredge plants, Lyman-Richey Sand & Gravel Corp., Fremont, Neb.—56,792 man-hours.
Irwindale dry-pit plant, Manning Brothers Rock & Sand Co., Irwindale, Calif.—55,163 man-hours.
Nos. 9 & 11 dredge plants, Lyman-Richey Sand & Gravel Corp., Valley, Neb.—54,678 man-hours.
Kingsbury wet-pit plant, Gravel Mining Co., Euless, Texas—54,201 man-hours.
Boonville No. 1 dry-bank plant, Eastern Rock Products, Inc., Boonville, N.Y.—39,804 man-hours.
Portland dry-bank plant, Portland Sand & Gravel Co., Portland, Penn.—37,566 man-hours.
Akron dry-bank plant, The Rubber City Sand & Gravel Co., Akron, Ohio—37,448 man-hours.
Rockfield No. 124 wet-pit plant, Pacific Coast Aggregates, Inc., Friant, Calif.—36,732 man-hours.
No. 2A dredge plant, Lyman-Richey Sand & Gravel Corp., La Platte, Neb.—35,518 man-hours.
Sierra No. 19 dry-pit plant, Consolidated Rock Products Co., Monrovia, Calif.—31,787 man-hours.
"F" dry-bank plant, The Buffalo Slag Co., Inc., Franklinville, N.Y.—30,728 man-hours.
Stauffer dry-pit plant, Utah Sand & Gravel Products Corp., Salt Lake City, Utah—27,431 man-hours.
Hollimon wet-pit plant, Texas Construction Material Co., Alleyton, Texas—24,750 man-hours.
Olympia No. 125 dry-pit plant, Pacific Coast Aggregates, Inc., Felton, Calif.—24,636 man-hours.
Arno dry-pit plant, F. M. Reeves & Sons, Inc., Pecos, Texas—21,856 man-hours.
No. 15 dredge plant, Lyman-Richey Sand & Gravel Corp., Columbus, Neb.—21,199 man-hours.
No. 23 dredge plant, Lyman-Richey Sand & Gravel Corp., Bridgeport, Neb.—20,865 man-hours.
South Bend dry-bank plant, South Bend Sand & Gravel Corp., South Bend, Ind.—20,570 man-hours.

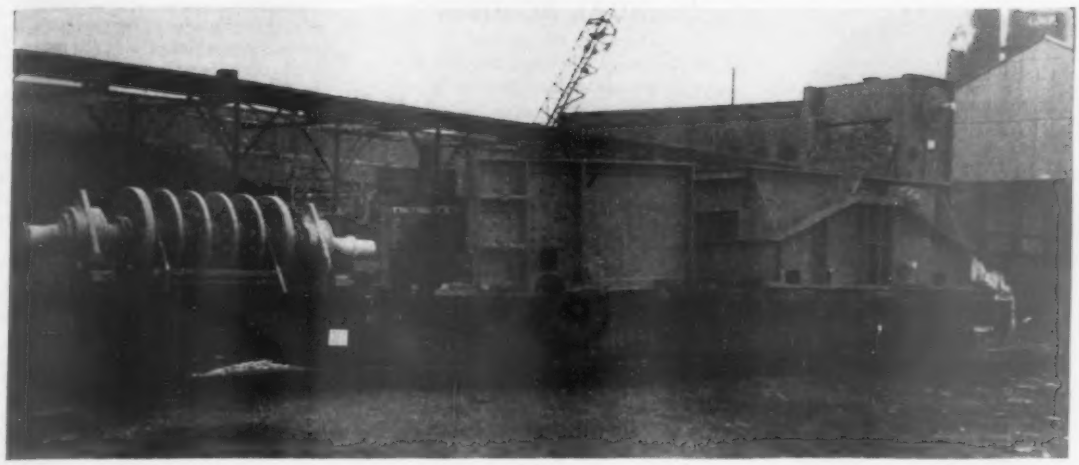
N.C.S.A. Safety Competition

THE NATIONAL CRUSHED STONE Safety Competition of 1951 experienced one of its best safety records in the 26-year history of the competition, as reported by the Bureau of Mines. The injury severity rate in 1951 of 2.515 days of lost time for each 1000 man-hours of operation was a 54 percent reduction from the rate of 5.462 in 1926, the first year of the competition, and was also the second lowest on record. The record rate of 1.093 was established in 1945. In 1951, the frequency rate of 19.182 injuries per million man-hours of work was the lowest rate since 1941 and the fourth lowest in the history of the competition.

The Port Inland quarry of Inland Lime and Stone Co., Gulliver, Mich., won the highest safety honors in the 1951 competition. This quarry won the bronze plaque provided by the *Explosives Engineer* magazine, for operating 808,389 man-hours during 1951, without a lost-time injury. This is the fifth time in the 19 years of its participation that the Port Inland quarry has won top honors. The other winning years were 1933, 1934, 1938 and 1939.

The Bell underground limestone mine of Warner Co., Bellefonte Division, Bellefonte, Penn., ranked second in the 1951 contest, working 327,395 man-hours without a lost-time injury. The Security quarry of North Ameri-

UNIVERSITY OF MICHIGAN LIBRARIES



ONE STAGE BULLDOG HAMMERMILL

NON-CLOG MOVING BREAKER PLATE

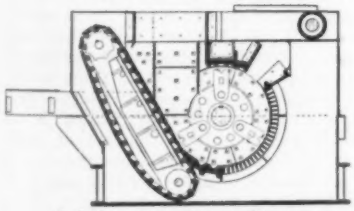
CAR LOADS

(PARTIAL SHIPMENT FOR ONE CUSTOMER)

BULLDOG HAMMERMILLS

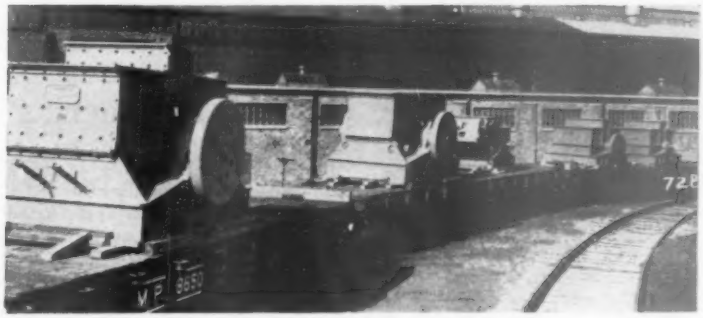
[PRIMARY - SECONDARY - FINE REDUCTION]

BULLDOG HAMMERMILLS for DRY OR WET STICKY MATERIALS FOR THOSE TOUGH HEAVY-DUTY CRUSHING JOBS 1 to 1000 ton capacity



Ask for List of Installations

ASK FOR LIST OF INSTALLATIONS



We will gladly survey your reduction requirements and recommend the proper equipment without cost or obligation. Just write or call.

HAMMERMILLS, INC.
4766 W. Division St.
Chicago 51, Illinois

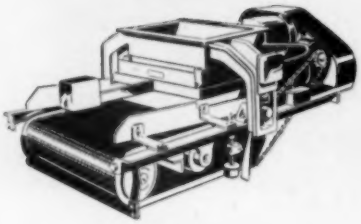
division of

PETTIBONE MULLIKEN CORP.
Phone SPaulding 2-9300

UNIVERSITY OF MICHIGAN LIBRARIES

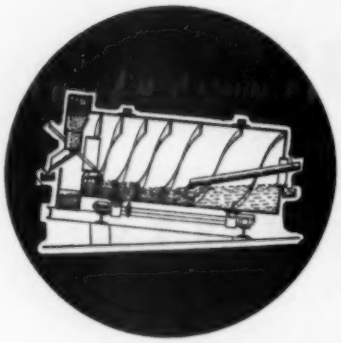
CONICAL SCRUBBER

Cleans by mass contact and natural displacement. Removes dirt and silt without wear on the scrubber. Classifying action of the cone holds back the large clay balls until properly disintegrated. Foreign materials, such as sticks, vegetation or large pieces of metal can do no harm. Power requirements are considerably less than that of other methods. Repair costs are negligible. Bulletin 37-A-7.



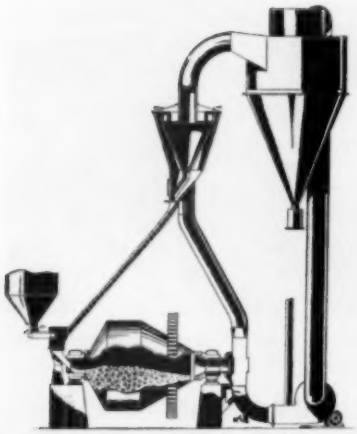
CONSTANT-WEIGHT FEEDERS

Regulate the feeding of materials at a constant-weight rate, rather than a constant-volume rate. The feeder automatically compensates for changes in specific gravity and bulking, due to moisture, which would cause irregular feeding. Bulletin 33-D-7.



COUNTER-CURRENT CLASSIFIER

Produces closer sizing and cleaner oversize because of its unique construction. It is a slowly rotating drum, on the inner surface of which is attached a screw flight. Coarse material is separated from the fines by gravity. Settled granular particles are rolled forward by the screw flight and washed with a counter-flow of wash water. Fines and wash water overflow through an opening at the discharge end. Oversize is elevated by buckets and discharged. Will operate in closed circuit with a grinding mill without the use of conveyors or pumps. Bulletin 39-B-7.



AIR CLASSIFIERS

The Hardinge Air Classifier, operation in conjunction with the Hardinge Mill, is a compact, self-contained unit of unusual efficiency. The material is conveyed without auxiliary apparatus to any convenient location in the building. The Hardinge "Loop" Classifier delivers products ranging from 50% to 90% minus 200 mesh. The Hardinge "Superfine" Classifier (illustrated) can produce 99½ plus % passing 325 mesh. Bulletin 17-B-7.

HARDINGE
COMPANY, INCORPORATED

YORK, PENNSYLVANIA—240 Arch St. Main Office and Works

NEW YORK 17 • SAN FRANCISCO 11 • CHICAGO 6 • HIBBING, MINN. • TORONTO 1
122 E. 42nd St. 24 California St. 205 W. Wacker Dr. 2016 First Ave. 200 Bay St.

can Cement Corp., Hagerstown, Md., won third place safety honors with its accomplishment of 172,061 man-hours of safe operation.

Of the 42 plants enrolled in the 1951 competition, ten had injury-free records, working an aggregate of 1,818,241 man-hours, or slightly more than 27 percent of the total worktime of all 42 enrolled plants. The following plants also had injury-free records.

LeRoy quarry, The General Crushed Stone Co., LeRoy, N.Y.—124,617 man-hours.
Rock Hill quarry, The General Crushed Stone Co., Quakertown, Penn.—92,812 man-hours.
Auburn quarry, The General Crushed Stone Co., Auburn, N.Y.—89,873 man-hours.
Jordanville quarry, The General Crushed Stone Co., Jordanville, N.Y.—76,039 man-hours.
Middlefield No. 1 quarry, The New Haven Trap Rock Co., Middlefield, Conn.—57,299 man-hours.
Plainville No. 4 quarry, The New Haven Trap Rock Co., Plainville, Conn.—47,756 man-hours.
McCoy quarry, Warner Co., Bridgeport, Penn.—22,000 man-hours.

Asbestos Survey

ABOUT 2½ YEARS AGO the National Security Resources Board sponsored a series of "Materials Survey Reports" designed to present, particularly to defense agencies, basic background information pertaining to certain minerals that are of special importance in the program of military preparedness. Six of the reports have been completed. They deal with asbestos, antimony, lead, zinc, nickel and cobalt. The asbestos report was prepared by Oliver Bowles, consultant with the Bureau of Mines.

It may seem strange that asbestos was chosen for such a report because asbestos mining is of small importance in the United States. There is one moderate-sized operation in Vermont, about a dozen small mines in Arizona, and sporadic, small-scale production in several other states. The importance of the mineral lies in the fact that it has a variety of essential uses, and that the United States has developed the greatest asbestos-product manufacturing industry of any country in the world; in fact, the United States used more asbestos in 1950 and 1951 than all other countries of the world combined. As only 6 or 8 percent of these large requirements are produced within the borders of the United States it is evident that foreign sources of supply are of the utmost importance.

Asbestos consists of fine fibers like those of silk, cotton or wool. The fibers generally occur in irregular veins in a dark green rock named "serpentine." The fiber-bearing rock is mined deep in the earth, and the fiber is separated from the rock by a complex milling process, an important feature of which is the use of a series of hoods through which the separated fiber is drawn from the screen surfaces by air suction.

Asbestos products are of vital importance in modern industry. There are no known substitutes for asbestos used as brake linings and clutch facings of automobiles, trucks and other

TRACTION

You can trust

4-wheel drive PAYLOADER®

It takes traction in all kinds of going to get jobs done on schedule . . . traction you can rely on the year 'round . . . that handles big loads quickly, easily and economically.

Hundreds of mines, quarries and pits use Model HM "PAY-LOADERS" . . . many have placed repeat orders proving their satisfaction with the traction, flotation and all-around utility of this unusual wheeled tractor-shovel. They also value its ability to get to the job and around the job fast . . . the way it can do so many jobs — dig, load big hauling units, strip overburden, do clean-up work, maintain haul roads, carry tools and equipment, do crane work, pull and push.

Operators like its ease of operation, thanks to power-boosted steering, fingertip hydraulic control, the quick, easy shift between the four forward speeds and four reverse speeds. Once you see the Model HM "PAYLOADER" in action you'll want one too, so see your "PAYLOADER" Distributor or write The Frank G. Hough Co., 705 Sunnyside Avenue, Libertyville, Illinois.

WRITE for catalog on the 1½ yd. Model HM or the six other "PAYLOADER" sizes down to 12 cu. ft. bucket capacity.

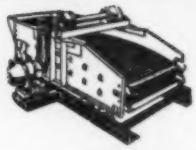
PAYLOADER®

SAY "HUFF"

THE FRANK G. HOUGH CO. • Since 1920

"DEISTERS Stand-up Far Better"

Enthused over Snyder & Sons' new Deister screen, Supt. Moss Davis said, "I've been in the gravel business 25 years and have used many makes of screens—but Deisters stand up far better than any other."



That was the consensus found among aggregates men by M. G. Snyder and Sons, Dayton, Ohio, aggregates operators, when they needed to replace an unsatisfactory screen a year ago.

Now, R. L. Snyder, General Manager, reports their satisfaction this way: "This is our first Deister. We like the way it turns out the work. When we found it necessary to replace an unsatisfactory screen, we checked with other plants around here, and bought a Deister because of the excellent reports we got on it."

Wire, phone or write for detailed information on Deister screens or the new Deister electric screen heating units.

DEISTER VIBRATING SCREENS & DEISTER ELECTRIC SCREEN HEATERS

DEISTER SCREENS

DEISTER MACHINE COMPANY

FORT WAYNE 4, INDIANA

mobile equipment. Hence a shortage of asbestos of the types used in friction materials would immobilize highway transport to a corresponding degree. There are no known substitutes for asbestos used in steam packings, and a shortage of such products would interfere seriously with many lines of industrial activity. The Navy requires large quantities of lagging cloth and cable coverings that are made of asbestos, and substitution of other materials has been possible only to a limited degree. The procurement of necessary supplies is a problem of world-wide scope, and in every war emergency asbestos assumes high priority among strategic minerals.

About 95 percent of the world production of asbestos is the variety chrysotile which usually consists of strong, flexible fibers. The most valuable grades are the spinning fibers which must be ¾ in. long or longer. They constitute only a small percentage of total production. The shorter grades are used for making asbestos-cement building materials, such as roofing shingles and siding. Asbestos paper, millboard, insulation products, and molded brake linings are other widely used products in which the shorter fibers are employed. An important variety in the military program is the low-iron chrysotile mined in Southern Rhodesia. It is used by the Navy for fireproof electric cable coverings on ships, a use for which the more abundant Canadian chrysotile cannot be employed because of its relatively high iron content. The only other chrysotile now mined in the world which is satisfactory for such use is that obtained in Arizona, and the supply from that source is limited.

Amosite is another variety of asbestos that has important military uses, and which is mined only in the Union of South Africa. A peculiar variety known as blue asbestos is mined only in the Union of South Africa, Australia and Bolivia. No commercial deposits are known in North America.

The only large deposits of asbestos being commercially worked in the free world are those of Canada, the Union of South Africa, Swaziland and Southern Rhodesia. Soviet Russia has large supplies in the Ural mountains. Because the deposits are widely scattered over the face of the earth, certain important varieties and grades being found almost exclusively in Africa, and because the more important varieties are generally in short supply during emergencies, many difficult problems must be solved if the more urgent needs of the United States are to be satisfied. These conditions create a situation that justifies a careful review of all the factors pertaining to supply, requirements, and use—a task which the report is designed to accomplish.

The manner in which the report just published covers the leading fea-

UNIVERSITY OF MICHIGAN LIBRARIES

AND READY FOR ANY JOB

P&H MAGNETORQUE* Electric

Swing is 15% to 25% faster than any 2½ yd. shovel

If it's husky strength you want, this is it! Tough all-welded construction throughout to take pounding and shock loads that would K.O. less rugged machines. It means steady digging — less maintenance — down through the years.

If it's speed, you have it Magnetorque — speed to out-produce any other machine in the 2½ yd. class — with a swing that's 15% to 25% faster. It's the greatest shovel improvement in 20 years. We'll gladly tell you where to see the 955-A working nearest you. Ask today!

If you want larger capacity, ask for facts about the Model 1055 (3½ yd.).

*T.M. of Harnischfeger Corporation for electro-magnetic type clutch.

P&H POWER SHOVELS & CRANES

HARNISCHFEGER

CORPORATION

4400 W. National Avenue • Milwaukee 46, Wisconsin

POWER SHOVELS • CRAWLER AND TRUCK CRANES • OVERHEAD CRANES • HOISTS • ARC WELDERS AND ELECTRODES • SOIL STABILIZERS • DIESEL ENGINES • PRE-FABRICATED HOMES

CF&I STEEL PRODUCTS FOR THE MINING INDUSTRY

FORGED STEEL GRINDING BALLS

Good for the Long Grind

You'll find CF&I Grinding Balls where the going is toughest. They're forged from special analysis steel to give high impact and abrasion resistance... wear evenly and stay spherical.

If you have any grinding problem, call upon CF&I metallurgists and engineers for assistance... they're always available to help you obtain the most from your grinding media.

CF&I PRODUCTS FOR THE MINING INDUSTRY

Cal-Wic Wire Cloth Screens • Grinding Balls • Wickwire Rope • Mine Rails and Accessories • Grinding Rods Rock Bolts

THE CALIFORNIA WIRE CLOTH CORPORATION • OAKLAND
THE COLORADO FUEL AND IRON CORPORATION • DENVER and NEW YORK

CF&I FORGED STEEL GRINDING BALLS
FOR COLORADO FUEL AND IRON CORPORATION

1131

tures of the industry is indicated by the following 18 chapter headings: varieties and composition of asbestos; description of deposits; mining methods; milling methods; grading and classification; world production; world reserves; political and commercial controls; international trade; marketing; prices; uses and requirements of use; substitutes for asbestos; beneficiation of asbestos; synthetic asbestos; problem of low-iron asbestos; search for new sources of supply; and World War II controls and experiences. Several maps and charts and numerous statistical tables are included. The report comprising 153 pages has been issued in loose-leaf form with each chapter paged separately because it is planned to revise it periodically as conditions change and new facts become available. A limited supply of loose-leaf copies has been printed, but the Government Printing Office, Washington 25, D.C., has issued a bound edition which sells for $1.25 a copy.

Importing Aggregates

ASPHALT PAVING PRODUCTS, INC., Detroit, Mich., is importing crushed stone for mixing and topping for highway construction and maintenance from Canada. Arrangements have been made with producers in the Hamilton-Toronto area to supply 500,000 tons of material.

New Cement Silos Planned

FEDERAL PORTLAND CEMENT CO., INC., Buffalo, N.Y., recently announced plans for increasing its cement storage capacity by 50 percent at its Buffalo plant on Lake Shore Road. Total expenditure for the expansion was estimated at $350,000.

A contract has been awarded Shirley-Herman Co., Inc., for the erection of four additional silos, each with a 25,000 bbl. capacity. The silos, which will be 34 ft. in dia. x 104 ft. high, will be erected on concrete piers, so that loading trucks may be driven underneath.

The plant now has 21 storage silos with a combined capacity of 200,000 bbl. The new silos will increase storage capacity to 400,000 bbl.

The company expects to be called upon by the state to furnish considerable cement for construction of the New York State Thruway next year.

Pegmatite Mined

FOOTE MINERAL CO., Philadelphia, Penn., is now mining more than 350 tons of pegmatite a day from its property 5 mi. south of King Mountain, N.M. The company says the property has taken on a commercial significance as a supply of lithium-bearing ores. Open-pit methods are used in mining and spodumene is obtained by flotation from the crushed pegmatite. Possible by-products include tin concentrates, columbite, feldspar, mica and silica quartz.

UNIVERSITY OF MICHIGAN LIBRARIES

Executive Vice-President

DR. ERNEST W. GREENE has been elected executive vice-president and director of research of Minerals Separation North American Corp., Lakeland, Fla. Dr. Greene has for some years been resident manager of the research laboratory at Lakeland, where he was active in the development of processes for the flotation of phosphate ores. Research at the Lakeland laboratory has also developed processes for the flotation of potash ores. The new resident manager of the laboratory is Wesley M. Houston, formerly chief engineer.

Earl H. Brown has been appointed assistant to the executive vice-president and assistant director of research. Mr. Brown is co-inventor of the company's processes for the treatment of low-grade iron ore and other flotation processes. David E. Lilienthal, president of the company, announced the opening of an office and laboratory at Carlsbad, N.M., to service licensees of the company's potash flotation processes, and for further development work. This laboratory will be in charge of James B. Duke as resident manager. Mr. Duke has long been connected with the company's development work in both phosphate and potash ores.

Dr. Seth Gregory, who recently retired as president after nearly 50 years of service with Minerals Separation, will continue his association with the company as a consultant, and William Trotter, who plans to retire soon from active direction of research, will also become a consultant for the company.

The general offices of the corporation have been moved from New York to Lakeland, Fla.

Heads Asbestos Firm

WILLIAM L. KEADY, former president of United States Gypsum Co., Chicago, Ill., has been elected president and director of Pabco Products, Inc., San Francisco, Calif., manufacturer of asbestos roofing and building materials, floor coverings and related products. William H. Lowe, president of Pabco, was named chairman of the board. Mr. Keady joined United States Gypsum in 1924. He became production manager four years later. In 1932 he was elected vice-president in charge of operations and four years later was made vice-president in charge of sales. He became president in 1942, resigning in 1949 to assume the presidency of Marathon Paper Corp.

Vice-President of Sales

DEAN R. GIDNEY has been appointed vice-president in charge of sales of United States Potash Co., Carlsbad, N.M. He succeeds J. E. Barnes, who has retired because of ill health. Mr. Gidney has been in the sales department since 1938, except for war service in the Navy, and has been sales manager since 1950.

NOW up to 22% more payload capacity per dollar

MATCHED FOR EXTRA PROFITS

Rugged new St. Paul dump bodies are perfectly "teamed" for maximum output with the new extra capacity St. Paul hoists. They're huskier, tougher.

Check St. Paul before you buy!

Whether you need a single standard duty body hoist, or a fleet of heavy duty twins, you'll get *more payload capacity per dollar, per pound of weight in the new St. Paul line.* This is because St. Paul — pioneer builder of the first hydraulic hoists 40 years ago — has "scooped" the industry again with *over 50 advanced engineering improvements no other hoist can match.* See these great new 6 to 31-ton capacity hoists and matching dump bodies at your St. Paul Distributor today, or write direct for free literature.

ALL NEW for '52!

QUICK FACTS

1. New "center-push" design means easier lifting, reduced hinge loads.
2. New equi-lift strut arms eliminate uneven stresses, prevent binding.
3. New tapered cylinder head reduces mounting height, increases leverage up to 25%.
4. New uni-flex subframe provides more strength with less weight.
5. New friction-free pump assures added power, lower oil pressures.

MAIL COUPON

St. Paul HYDRAULIC

Hoists & Dump Bodies • Rubber Loaders Truck Pulpits • Elevating End Gates

ST. PAUL HYDRAULIC HOIST
Customer Service Department
36123 Main St., WAYNE, MICH.

Send free literature on new St. Paul
☐ Hoists ☐ Dump Bodies

Name _____
Title _____
Employed by _____
Address _____
City _____ State _____

S-HBC-2

More Tonnage

"Cape Ann"
Forged
Steel Drop Ball

Ruggedly designed and drop tested to insure maximum breakage. Lifting link protected by deep recess to minimize cable replacement. Adaptable for swivel or shackle.

Used by leading quarries for *economical secondary breakage.*

2000 to 8000 lbs.

Prompt Shipments

For further information write—

Cape Ann Anchor & Forge Co.
Post Office Box 360
Gloucester, Mass.

Crushing Practice

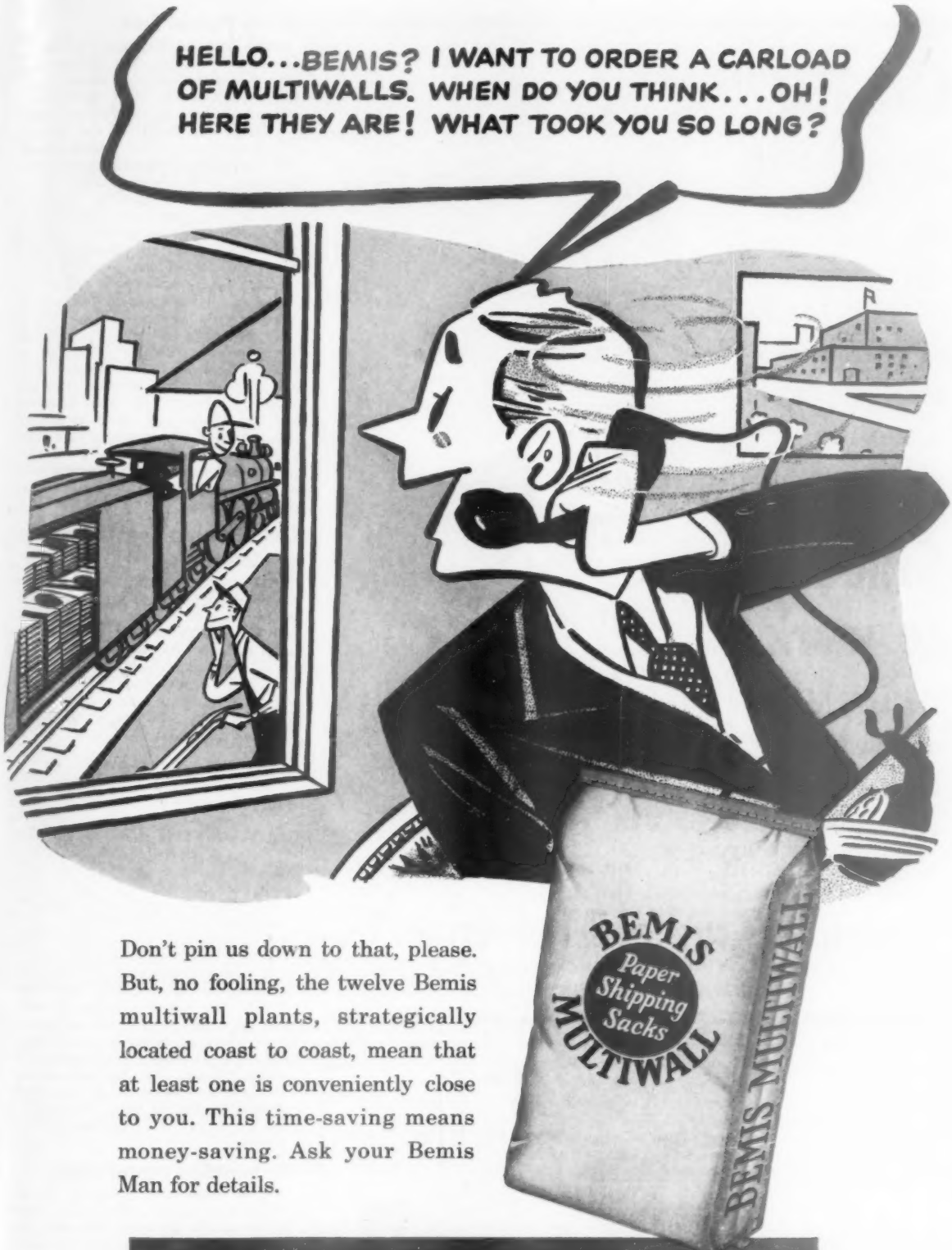
(Continued from page 109)

deal in crushing and screening computations. The infinite variety of shapes encountered renders absolute accuracy an impossible attainment. Practical experience, however, indicates that the comparisons shown in our table are in most cases close enough for all practical purposes.

(To be continued)

Table II. Relation between round and square holes in revolving, vibrating, and flat testing screens

Product size		Corresponding size holes		
Through a flat testing screen		Allis-Chalmers centrifugal vibrating screen		Revolving screen
Round holes	Square holes	Round holes	Square holes	Round holes
1/8	5/32	5/32	1/8	5/32
5/32	3/16	3/16	5/32	1/4
3/16	7/32	7/32	3/16	7/32
7/32	1/4	1/4	7/32	9/32
9/32	5/16	9/32	1/4	5/16
5/16	11/32	5/16	9/32	11/32
11/32	3/8	11/32	5/16	3/8
3/8	13/32	3/8	11/32	13/32
13/32	7/16	13/32	3/8	7/16
7/16	15/32	7/16	13/32	15/32
1/2	1/2	15/32	7/16	1
9/16	17/32	1/2	15/32	1 1/16
5/8	9/16	9/16	1/2	1 1/8
11/16	19/32	5/8	9/16	1 3/16
3/4	5/8	11/16	5/8	1 1/4
13/16	21/32	3/4	11/16	1 5/16
7/8	11/16	13/16	3/4	1 3/8
15/16	23/32	7/8	13/16	1 7/16
1	3/4	15/16	7/8	1 1/2
1 1/16	25/32	1 1/16	15/16	1 9/16
1 1/8	13/16	1 1/8	1	1 5/8
1 3/16	27/32	1 3/16	1 1/16	1 11/16
1 1/4	7/8	1 1/4	1 1/8	1 3/4
1 5/16	29/32	1 5/16	1 3/16	1 13/16
1 3/8	15/16	1 3/8	1 1/4	1 7/8
1 7/16	31/32	1 7/16	1 5/16	2
1 1/2	1	1 1/2	1 3/8	2 1/16
1 9/16	1 1/32	1 9/16	1 7/16	2 1/8
1 5/8	1 1/16	1 5/8	1 1/2	2 3/16
1 11/16	1 3/32	1 11/16	1 9/16	2 1/4
1 3/4	1 1/8	1 3/4	1 5/8	2 5/16
1 13/16	1 5/32	1 13/16	1 11/16	2 3/8
1 7/8	1 3/16	1 7/8	1 3/4	2 7/16
1 15/16	1 7/32	1 15/16	1 13/16	2 1/2
2	1 1/4	2	1 7/8	2 9/16
2 1/16	1 9/32	2 1/16	1 15/16	2 5/8
2 1/8	1 5/16	2 1/8	2	2 11/16
2 3/16	1 11/32	2 3/16	2 1/16	2 3/4
2 1/4	1 3/8	2 1/4	2 1/8	2 13/16
2 5/16	1 13/32	2 5/16	2 3/16	2 7/8
2 3/8	1 7/16	2 3/8	2 1/4	2 15/16
2 7/16	1 15/32	2 7/16	2 5/16	3
2 1/2	1 1/2	2 1/2	2 3/8	3 1/16
2 9/16	1 17/32	2 9/16	2 7/16	3 1/8
2 5/8	1 9/16	2 5/8	2 1/2	3 3/16
2 11/16	1 19/32	2 11/16	2 9/16	3 1/4
2 3/4	1 5/8	2 3/4	2 5/8	3 5/16
2 13/16	1 21/32	2 13/16	2 11/16	3 3/8
2 7/8	1 11/16	2 7/8	2 3/4	3 7/16
2 15/16	1 23/32	2 15/16	2 13/16	3 1/2
3	1 3/4	3	2 7/8	3 9/16
3 1/16	1 25/32	3 1/16	2 15/16	3 5/8
3 1/8	1 13/16	3 1/8	3	3 11/16
3 3/16	1 27/32	3 3/16	3 1/16	3 3/4
3 1/4	1 7/8	3 1/4	3 1/8	3 13/16
3 5/16	1 29/32	3 5/16	3 3/16	3 7/8
3 3/8	1 15/16	3 3/8	3 1/4	3 15/16
3 7/16	1 31/32	3 7/16	3 5/16	4
3 1/2	2	3 1/2	3 3/8	4 1/16
3 9/16	2 1/32	3 9/16	3 7/16	4 1/8
3 5/8	2 1/16	3 5/8	3 1/2	4 3/16
3 11/16	2 3/32	3 11/16	3 9/16	4 1/4
3 3/4	2 1/8	3 3/4	3 5/8	4 5/16
3 13/16	2 5/32	3 13/16	3 11/16	4 3/8
3 7/8	2 3/16	3 7/8	3 3/4	4 7/16
3 15/16	2 7/32	3 15/16	3 13/16	4 1/2
4	2 1/4	4	3 7/8	4 9/16
4 1/16	2 9/32	4 1/16	3 15/16	4 5/8
4 1/8	2 5/16	4 1/8	4	4 11/16
4 3/16	2 11/32	4 3/16	4 1/16	4 3/4
4 1/4	2 3/8	4 1/4	4 1/8	4 13/16
4 5/16	2 13/32	4 5/16	4 3/16	4 7/8
4 3/8	2 7/16	4 3/8	4 1/4	4 15/16
4 7/16	2 15/32	4 7/16	4 5/16	5
4 1/2	2 1/2	4 1/2	4 3/8	5 1/16
4 9/16	2 17/32	4 9/16	4 7/16	5 1/8
4 5/8	2 9/16	4 5/8	4 1/2	5 3/16
4 11/16	2 19/32	4 11/16	4 9/16	5 1/4
4 3/4	2 5/8	4 3/4	4 5/8	5 5/16
4 13/16	2 21/32	4 13/16	4 11/16	5 3/8
4 7/8	2 11/16	4 7/8	4 3/4	5 7/16
4 15/16	2 23/32	4 15/16	4 13/16	5 1/2
5	2 3/4	5	4 7/8	5 9/16
5 1/16	2 25/32	5 1/16	4 15/16	5 5/8
5 1/8	2 13/16	5 1/8	5	5 11/16
5 3/16	2 27/32	5 3/16	5 1/16	5 3/4
5 1/4	2 7/8	5 1/4	5 1/8	5 13/16
5 5/16	2 29/32	5 5/16	5 3/16	5 7/8
5 3/8	2 15/16	5 3/8	5 1/4	5 15/16
5 7/16	2 31/32	5 7/16	5 5/16	6
5 1/2	3	5 1/2	5 3/8	6 1/16
5 9/16	3 1/32	5 9/16	5 7/16	6 1/8
5 5/8	3 1/16	5 5/8	5 1/2	6 3/16
5 11/16	3 3/32	5 11/16	5 9/16	6 1/4
5 3/4	3 1/8	5 3/4	5 5/8	6 5/16
5 13/16	3 5/32	5 13/16	5 11/16	6 3/8
5 7/8	3 3/16	5 7/8	5 3/4	6 7/16
5 15/16	3 7/32	5 15/16	5 13/16	6 1/2
6	3 1/4	6	5 7/8	6 9/16
6 1/16	3 9/32	6 1/16	5 15/16	6 5/8
6 1/8	3 5/16	6 1/8	6	6 11/16
6 3/16	3 11/32	6 3/16	6 1/16	6 3/4
6 1/4	3 3/8	6 1/4	6 1/8	6 13/16
6 5/16	3 13/32	6 5/16	6 3/16	6 7/8
6 3/8	3 7/16	6 3/8	6 1/4	6 15/16
6 7/16	3 15/32	6 7/16	6 5/16	7
6 1/2	3 1/2	6 1/2	6 3/8	7 1/16
6 9/16	3 17/32	6 9/16	6 7/16	7 1/8
6 5/8	3 9/16	6 5/8	6 1/2	7 3/16
6 11/16	3 19/32	6 11/16	6 9/16	7 1/4
6 3/4	3 5/8	6 3/4	6 5/8	7 5/16
6 13/16	3 21/32	6 13/16	6 11/16	7 3/8
6 7/8	3 11/16	6 7/8	6 3/4	7 7/16
6 15/16	3 23/32	6 15/16	6 13/16	7 1/2
7	3 3/4	7	6 7/8	7 9/16
7 1/16	3 25/32	7 1/16	6 15/16	7 5/8
7 1/8	3 13/16	7 1/8	7	7 11/16
7 3/16	3 27/32	7 3/16	7 1/16	7 3/4
7 1/4	3 7/8	7 1/4	7 1/8	7 13/16
7 5/16	3 29/32	7 5/16	7 3/16	7 7/8
7 3/8	3 15/16	7 3/8	7 1/4	7 15/16
7 7/16	3 31/32	7 7/16	7 5/16	8
7 1/2	4	7 1/2	7 3/8	8 1/16
7 9/16	4 1/32	7 9/16	7 7/16	8 1/8
7 5/8	4 1/16	7 5/8	7 1/2	8 3/16
7 11/16	4 3/32	7 11/16	7 9/16	8 1/4
7 3/4	4 1/8	7 3/4	7 5/8	8 5/16
7 13/16	4 5/32	7 13/16	7 11/16	8 3/8
7 7/8	4 3/16	7 7/8	7 3/4	8 7/16
7 15/16	4 7/32	7 15/16	7 13/16	8 1/2
8	4 1/4	8	7 7/8	8 9/16
8 1/16	4 9/32	8 1/16	7 15/16	8 5/8
8 1/8	4 5/16	8 1/8	8	8 11/16
8 3/16	4 11/32	8 3/16	8 1/16	8 3/4
8 1/4	4 3/8	8 1/4	8 1/8	8 13/16
8 5/16	4 13/32	8 5/16	8 3/16	8 7/8
8 3/8	4 7/16	8 3/8	8 1/4	8 15/16
8 7/16	4 15/32	8 7/16	8 5/16	9
8 1/2	4 1/2	8 1/2	8 3/8	9 1/16
8 9/16	4 17/32	8 9/16	8 7/16	9 1/8
8 5/8	4 9/16	8 5/8	8 1/2	9 3/16
8 11/16	4 19/32	8 11/16	8 9/16	9 1/4
8 3/4	4 5/8	8 3/4	8 5/8	9 5/16
8 13/16	4 21/32	8 13/16	8 11/16	9 3/8
8 7/8	4 11/16	8 7/8	8 3/4	9 7/16
8 15/16	4 23/32	8 15/16	8 13/16	9 1/2
9	4 3/4	9	8 7/8	9 9/16
9 1/16	4 25/32	9 1/16	8 15/16	9 5/8
9 1/8	4 13/16	9 1/8	9	9 11/16
9 3/16	4 27/32	9 3/16	9 1/16	9 3/4
9 1/4	4 7/8	9 1/4	9 1/8	9 13/16
9 5/16	4 29/32	9 5/16	9 3/16	9 7/8
9 3/8	4 15/16	9 3/8	9 1/4	9 15/16
9 7/16	4 31/32	9 7/16	9 5/16	10
9 1/2	5	9 1/2	9 3/8	10 1/16
9 9/16	5 1/32	9 9/16	9 7/16	10 1/8
9 5/8	5 1/16	9 5/8	9 1/2	10 3/16
9 11/16	5 3/32	9 11/16	9 9/16	10 1/4
9 3/4	5 1/8	9 3/4	9 5/8	10 5/16
9 13/16	5 5/32	9 13/16	9 11/16	10 3/8
9 7/8	5 3/16	9 7/8	9 3/4	10 7/16
9 15/16	5 7/32	9 15/16	9 13/16	10 1/2
10	5 1/4	10	9 7/8	10 9/16
10 1/16	5 9/32	10 1/16	9 15/16	10 5/8
10 1/8	5 5/16	10 1/8	10	10 11/16
10 3/16	5 11/32	10 3/16	10 1/16	10 3/4
10 1/4	5 3/8	10 1/4	10 1/8	10 13/16
10 5/16	5 13/32	10 5/16	10 3/16	10 7/8
10 3/8	5 7/16	10 3/8	10 1/4	10 15/16
10 7/16	5 15/32	10 7/16	10 5/16	11
10 1/2	5 1/2	10 1/2	10 3/8	11 1/16
10 9/16	5 17/32	10 9/16	10 7/16	11 1/8
10 5/8	5 9/16	10 5/8	10 1/2	11 3/16
10 11/16	5 19/32	10 11/16	10 9/16	11 1/4
10 3/4	5 5/8	10 3/4	10 5/8	11 5/16
10 13/16	5 21/32	10 13/16	10 11/16	11 3/8
10 7/8	5 11/16	10 7/8	10 3/4	11 7/16
10 15/16	5 23/32	10 15/16	10 13/16	11 1/2
11	5 3/4	11	10 7/8	11 9/16
11 1/16	5 25/32	11 1/16	10 15/16	11 5/8
11 1/8	5 13/16	11 1/8	11	11 11/16
11 3/16	5 27/32	11 3/16	11 1/16	11 3/4
11 1/4	5 7/8	11 1/4	11 1/8	11 13/16
11 5/16	5 29/32	11 5/16	11 3/16	11 7/8
11 3/8	5 15/16	11 3/8	11 1/4	11 15/16
11 7/16	5 31/32	11 7/16	11 5/16	12
11 1/2	6	11 1/2	11 3/8	12 1/16
11 9/16	6 1/32	11 9/16	11 7/16	12 1/8
11 5/8	6 1/16	11 5/8	11 1/2	12 3/16
11 11/16	6 3/32	11 11/16	11 9/16	12 1/4
11 3/4	6 1/8	11 3/4	11 5/8	12 5/16
11 13/16	6 5/32	11 13/16	11 11/16	12 3/8
11 7/8	6 3/16	11 7/8	11 3/4	12 7/16
11 15/16	6 7/32	11 15/16	11 13/16	12 1/2
12	6 1/4	12	11 7/8	12 9/16
12 1/16	6 9/32	12 1/16	11 15/16	12 5/8
12 1/8	6 5/16	12 1/8	12	12 11/16
12 3/16	6 11/32	12 3/16	12 1/16	12 3/4
12 1/4	6 3/8	12 1/4	12 1/8	12 13/16
12 5/16	6 13/32	12 5/16	12 3/16	12 7/8
12 3/8	6 7/16	12 3/8	12 1/4	12 15/16
12 7/16	6 15/32	12 7/16	12 5/16	13
12 1/2	6 1/2	12 1/2	12 3/8	13 1/16
12 9/16	6 17/32	12 9/16	12 7/16	13 1/8
12 5/8	6 9/16	12 5/8	12 1/2	13 3/16
12 11/16	6 19/32	12 11/16	12 9/16	13 1/4
12 3/4	6 5/8	12 3/4	12 5/8	13 5/16
12 13/16	6 21/32	12 13/16	12 11/16	13 3/8
12 7/8	6 11/16	12 7/8	12 3/4	13 7/16
12 15/16	6 23/32	12 15/16	12 13/16	13 1/2
13	6 3/4	13	12 7/8	13 9/16
13 1/16	6 25/32	13 1/16	12 15/16	13 5/8
13 1/8	6 13/16	13 1/8	13	13 11/16
13 3/16	6 27/32	13 3/16	13 1/16	13 3/4
13 1/4	6 7/8	13 1/4	13 1/8	13 13/16
13 5/16	6 29/32	13 5/16	13 3/16	13 7/8
13 3/8	6 15/16	13 3/8	13 1/4	13 15/16
13 7/16	6 31/32	13 7/16	13 5/16	14
13 1/2	7	13 1/2	13 3/8	14 1/16
13 9/16	7 1/32	13 9/16	13 7/16	14 1/8
13 5/8	7 1/16	13 5/8	13 1/2	14 3/16
13 11/16	7 3/32	13 11/16	13 9/16	14 1/4
13 3/4	7 1/8	13 3/4	13 5/8	14 5/16
13 13/16	7 5/32	13 13/16	13 11/16	14 3/8
13 7/8	7 3/16	13 7/8	13 3/4	14 7/16
13 15/16	7 7/32	13 15/16	13 13/16	14 1/2
14	7 1/4	14	13 7/8	14 9/16
14 1/16	7 9/32	14 1/16	13 15/16	14 5/8
14 1/8	7 5/16	14 1/8	14	14 11/16
14 3/16	7 11/32	14 3/16	14 1/16	14 3/4
14 1/4	7 3/8	14 1/4	14 1/8	14 13/16
14 5/16	7 13/32	14 5/16	14 3/16	14 7/8
14 3/8	7 7/16	14 3/8	14 1/4	14 15/16
14 7/16	7 15/32	14 7/16	14 5/16	15
14 1/2	7 1/2	14 1/2	14 3/8	15 1/16
14 9/16	7 17/32	14 9/16	14 7/16	15 1/8
14 5/8	7 9/16	14 5/8	14 1/2	15 3/16
14 11/16	7 19/32	14 11/16	14 9/16	15 1/4
14 3/4	7 5/8	14 3/4	14 5/8	15 5/16
14 13/16	7 21/32	14 13/16	14 11/16	15 3/8
14 7/8	7 11/16	14 7/8	14 3/4	15 7/16
14 15/16	7 23/32	14 15/16	14 13/16	15 1/2
15	7 3/4	15	14 7/8	15 9/16
15 1/16	7 25/32	15 1/16	14 15/16	15 5/8
15 1/8	7 13/16	15 1/8	15	15 11/16
15 3/16	7 27/32	15 3/16	15 1/16	15 3/4
15 1/4	7 7/8	15 1/4	15 1/8	15 13/16
15 5/16	7 29/32	15 5/16	15 3/16	15 7/8
15 3/8	7 15/16	15 3/8	15 1/4	15 15/16
15 7/16	7 31/32	15 7/16	15 5/16	16
15 1/2	8	15 1/2	15 3/8	16 1/16
15 9/16	8 1/32	15 9/16	15 7/16	16 1/8
15 5/8	8 1/16	15 5/8	15 1/2	16 3/16
15 11/16	8 3/32	15 11/16	15 9/16	16 1/4
15 3/4	8 1/8	15 3/4	15 5/8	16 5/16
15 13/16	8 5/32	15 13/16	15 11/16	16 3/8
15 7/8	8 3/16	15 7/8	15 3/4	16 7/16
15 15/16	8 7/32	15 15/16	15 13/16	16 1/2
16	8 1/4	16	15 7/8	16 9/16
16 1/16	8 9/32	16 1/16	15 15/16	16 5/8
16 1/8	8 5/16	16 1/8	16	16 11/16
16 3/16	8 11/32	16 3/16	16 1/16	16 3/4
16 1/4	8 3/8	16 1/4	16 1/8	16 13/16
16 5/16	8 13/32	16 5/16	16 3/16	16 7/8
16 3/8	8 7/16	16 3/8	16 1/4	16 15/16
16 7/16	8 15/32	16 7/16	16 5/16	17
16 1/2	8 1/2	16 1/2	16 3/8	17 1/16
16 9/16	8 17/32	16 9/16	16 7/16	17 1/8
16 5/8	8 9/16	16 5/8	16 1/2	17 3/16
16 11/16	8 19/32	16 11/16	16 9/16	17 1/4
16 3/4	8 5/8	16 3/4	16 5/8	17 5/16
16 13/16	8 21/32	16 13/16	16 11/16	17 3/8
16 7/8	8 11/16	16 7/8	16 3/4	17 7/16
16 15/16	8 23/32	16 15/16	16 13/16	17 1/2
17	8 3/4	17	16 7/8	17 9/16
17 1/16	8 25/32	17 1/16	16 15/16	17 5/8
17 1/8	8 13/16	17 1/8	17	17 11/16
17 3/16	8 27/32	17 3/16	17 1/16	17 3/4
17 1/4	8 7/8	17 1/4	17 1/8	17 13/16
17 5/16	8 29/32	17 5/16	17 3/16	17 7/8
17 3/8	8 15/16	17 3/8	17 1/4	17 15/16
17 7/16	8 31/32	17 7/16	17 5/16	18
17 1/2	9	17 1/2	17 3/8	18 1/16
17 9/16	9 1/32	17 9/16	17 7/16	18 1/8
17 5/8	9 1/16	17 5/8	17 1/2	18 3/16
17 11/16	9 3/32	17 11/16	17 9/16	18 1/4
17 3/4	9 1/8	17 3/4	17 5/8	18 5/16
17 13/16	9 5/32	17 13/16	17 11/16	18 3/8
17 7/8	9 3/16	17 7/8	17 3/4	18 7/16
17 15/16	9 7/32	17 15/16	17 13/16	18 1/2
18	9 1/4	18	17 7/8	18 9/16
18 1/16	9 9/32	18 1/16	17 15/16	18 5/8
18 1/8	9 5/16	18 1/8	18	18 11/16
18 3/16	9 11/32	18 3/16	18 1/16	18 3/4
18 1/4	9 3/8	18 1/4	18 1/8	18 13/16
18 5/16	9 13/32	18 5/16	18 3/16	18 7/8
18 3/8	9 7/16	18 3/8	18 1/4	18 15/16
18 7/16	9 15/32	18 7/16	18 5/16	19
18 1/2	9 1/2	18 1/2	18 3/8	19 1/16
18 9/16	9 17/32	18 9/16	18 7/16	19 1/8
18 5/8	9 9/16	18 5/8	18 1/2	19 3/16
18 11/16	9 19/32	18 11/16	18 9/16	19 1/4
18 3/4	9 5/8	18 3/4	18 5/8	19 5/16
18 13/16	9 21/32	18 13/16	18 11/16	19 3/8
18 7/8	9 11/16	18 7/8	18 3/4	19 7/16
18 15/16	9 23/32	18 15/16	18 13/16	19 1/2
19	9 3/4	19	18 7/8	19 9/16
19 1/16	9 25/32	19 1/16	18 15/16	19 5/8
19 1/8	9 13/16	19 1/8	19	19 11/16
19 3/16	9 27/32	19 3/16	19 1/16	19 3/4
19 1/4	9 7/8	19 1/4	19 1/8	19 13/16
19 5/16	9 29/32	19 5/16	19 3/16	19 7/8
19 3/8	9 15/16	19 3/8	19 1/4	19 15/16
19 7/16	9 31/32	19 7/16	19 5/16	20
19 1/2	10	19 1/2	19 3/8	20 1/16
19 9/16	10 1/32	19 9/16	19 7/16	20 1/8
19 5/8	10 1/16	19 5/8	19 1/2	20 3/16
19 11/16	10 3/32	19 11/16	19 9/16	20 1/4
19 3/4	10 1/8	19 3/4	19 5/8	20 5/16
19 13/16	10 5/32	19 13/16	19 11/16	20 3/8
19 7/8	10 3/16	19 7/8	19 3/4	20 7/16
19 15/16	10 7/32	19 15/16	19 13/16	20 1/2
20	10 1/4	20	19 7/8	20 9/16
20 1/16	10 9/32	20 1/16	19 15/16	20 5/8
20 1/8	10 5/16	20 1/8	20	20 11/16
20 3/16	10 11/32	20 3/16	20 1/16	20 3/4
20 1/4	10 3/8	20 1/4	20 1/8	20 13/16
20 5/16	10 13/32	20 5/16	20 3/16	20 7/8
20 3/8	10 7/16	20 3/8	20 1/4	20 15/16
20 7/16	10 15/32	20 7/16	20 5/16	21
20 1/2	10 1/2	20 1/2	20 3/8	21 1/16
20 9/16	10 17/32	20 9/16	20 7/16	21 1/8
20 5/8	10 9/16	20 5/8	20 1/2	21 3/16
20 11/16	10 19/32	20 11/16	20 9/16	21 1/4
20 3/4	10 5/8	20 3/4	20 5/8	21 5/16
20 13/16	10 21/32	20 13/16	20 11/16	21 3/8
20 7/8	10 11/16	20 7/8	20 3/4	21 7/16
20 15/16	10 23/32	20 15/16	20 13/16	21 1/2
21	10 3/4	21	20 7/8	21 9/16
21 1/16	10 25/32	21 1/16	20 15/16	21 5/8
21 1/8	10 13/16	21 1/8	21	21 11/16
21 3/16	10 27/32	21 3/16	21 1/16	21 3/4
21 1/4	10 7/8	21 1/4	21 1/8	21 13/16
21 5/16	10 29/32	21 5/16	21 3/16	21 7/8
21 3/8	10 15/16	21 3/8	21 1/4	21 15/16
21 7/16	10 31/32	21 7/16	21 5/16	22
21 1/2	11	21 1/2	21 3/8	22 1/16
21 9/16	11 1/32	21 9/16	21 7/16	22 1/8
21 5/8	11 1/16	21 5/8	21 1/2	22 3/16
21 11/16	11 3/32	21 11/16	21 9/16	22 1/4
21 3/4	11 1/8	21 3/4	21 5/8	22 5/16
21 13/16	11 5/32	21 13/16	21 11/16	22 3/8
21 7/8	11 3/16	21 7/8	21 3/4	22 7/16
21 15/16	11 7/32	21 15/16	21 13/16	22 1/2
22	11 1/4	22	21 7/8	22 9/16
22 1/16	11 9/32	22 1/16	21 15/16	22 5/8
22 1/8	11 5/16	22 1/8	22	22 11/16
22 3/16	11 11/32	22 3/16	22 1/16	22 3/4
22 1/4	11 3/8	22 1/4	22 1/8	22 13/16
22 5/16	11 13/32	22 5/16	22 3/16	22 7/8
22 3/8	11 7/16	22 3/8	22 1/4	22 15/16
22 7/16	11 15/32	22 7/16	22 5/16	23
22 1/2	11 1/2	22 1/2	22 3/8	23 1/16
22 9/16	11 17/32	22 9/16	22 7/16	23 1/8
22 5/8	11 9/16	22 5/8	22 1/2	23 3/16
22 11/16	11 19/32	22 11/16	22 9/16	23 1/4
22 3/4	11 5/8	22 3/4	22 5/8	23 5/16
22 13/16	11 21/32	22 13/16	22 11/16	23 3/8
22 7/8	11 11/16	22 7/8	22 3/4	23 7/16
22 15/16	11 23/32	22 15/16	22 13/16	23 1/2
23	11 3/4	23	22 7/8	23 9/16
23 1/16	11 25/32	23 1/16	22 15/16	23 5/8
23 1/8	11 13/16	23 1/8	23	23 11/16
23 3/16	11 27/32	23 3/16	23 1/16	23 3/4
23 1/4	11 7/8	23 1/4	23 1/8	23 13/16
23 5/16	11 29/32	23 5/16	23 3/16	23 7/8
23 3/8	11 15/16	23 3/8	23 1/4	23 15/16
23 7/16	11 31/32	23 7/16	23 5/16	24
23 1/2	12	23 1/2	23 3/8	24 1/16
23 9/16	12 1/32	23 9/16	23 7/16	24 1/8
23 5/8	12 1/16	23 5/8	23 1/2	24 3/16
23 11/16	12 3/32	23 11/16	23 9/16	24 1/4
23 3/4


HELLO...BEMIS? I WANT TO ORDER A CARLOAD OF MULTIWALLS. WHEN DO YOU THINK...OH! HERE THEY ARE! WHAT TOOK YOU SO LONG?
BEMIS
Paper Shipping Sacks
MULTIWALL
BEMIS MULTIWALL

Don't pin us down to that, please. But, no fooling, the twelve Bemis multiwall plants, strategically located coast to coast, mean that at least one is conveniently close to you. This time-saving means money-saving. Ask your Bemis Man for details.

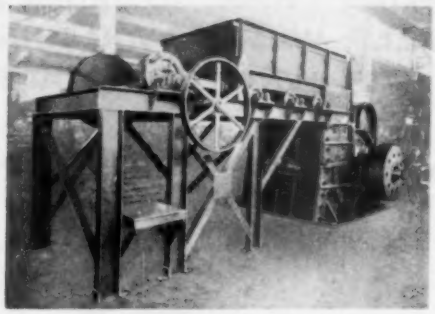
Bemis

BEMIS BRO BAG COMPANY

General Offices—St. Louis 2, Mo.
Offices in all Principal Cities

Get The Job Done

Step-up your production of AGGREGATES on an economical basis without interruption.



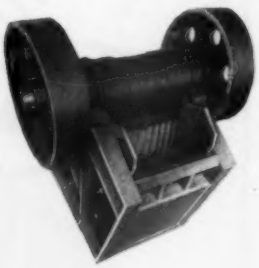
IMPACT HAMMER MILL
with Plate or Apron Feeder—
250 T.P.H.—1" minus

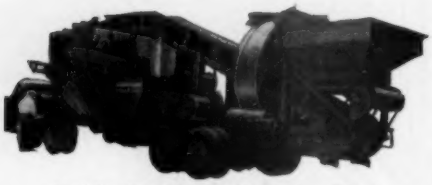
Put Gruendler to work

The long life of Gruendler Equipment is your assurance of continual profits.

Jaw Crushers

(All sizes) for first break or Quarry run rock primary crushing





Mobile Crushing & Screening Plant

Gruendler Crusher & Pulverizer Co.

Dept. RP, 2915 North Market, St. Louis 6, Mo.

CRUSHER ENGINEERS SINCE 1885

Buy U.S. SECURITY BONDS Now!

Potash Patent Suit

INTERNATIONAL MINERALS & CHEMICAL CORP., Chicago, Ill., offered defense testimony in the patent suit brought against it by Potash Company of America in the federal court at Albuquerque, N.M. The suit is over a method of processing potash mined near Carlsbad. Depositions of two witnesses, J. B. Clemmer and Dr. S. B. Cooke, were offered by International Minerals to state they discovered the process while employed by the Bureau of Mines. Evidence was offered by the potash company that the late L. D. Anderson, one of its employes, devised and obtained a patent on the process.

In the suit, involving a total of three patents, Potash Company of America seeks an injunction and general damages. The defense said the discovery claimed by Mr. Clemmer and Mr. Cooke was made at a time when Potash Company of America and the Bureau of Mines had a contract that any such development would be dedicated for general use in this country.

Determining Constituents of Limestone

AN APPLICATION of the ethylenediaminetetraacetic acid method for determination of calcium and magnesium in limestones and dolomites is described in *Analytical Chemistry*, July, 1952, page 1186 (Vol. 24, No. 7). The work was done by J. J. Banewicz and C. T. Kenner, Department of Chemistry, Southern Methodist University, Dallas, Texas.

Changes Firm Name

COMBUSTION BY-PRODUCTS CO., Chicago, Ill., has announced the change of its firm name to Chicago Fly Ash Co. Officers of the company are Craig J. Cain, president; J. D. Mollendorf, vice-president; C. E. Lovewell, sales manager; Norman H. Withey, technical representative; and Armand E. Hanshaw, traffic manager.

Zirconium Plant

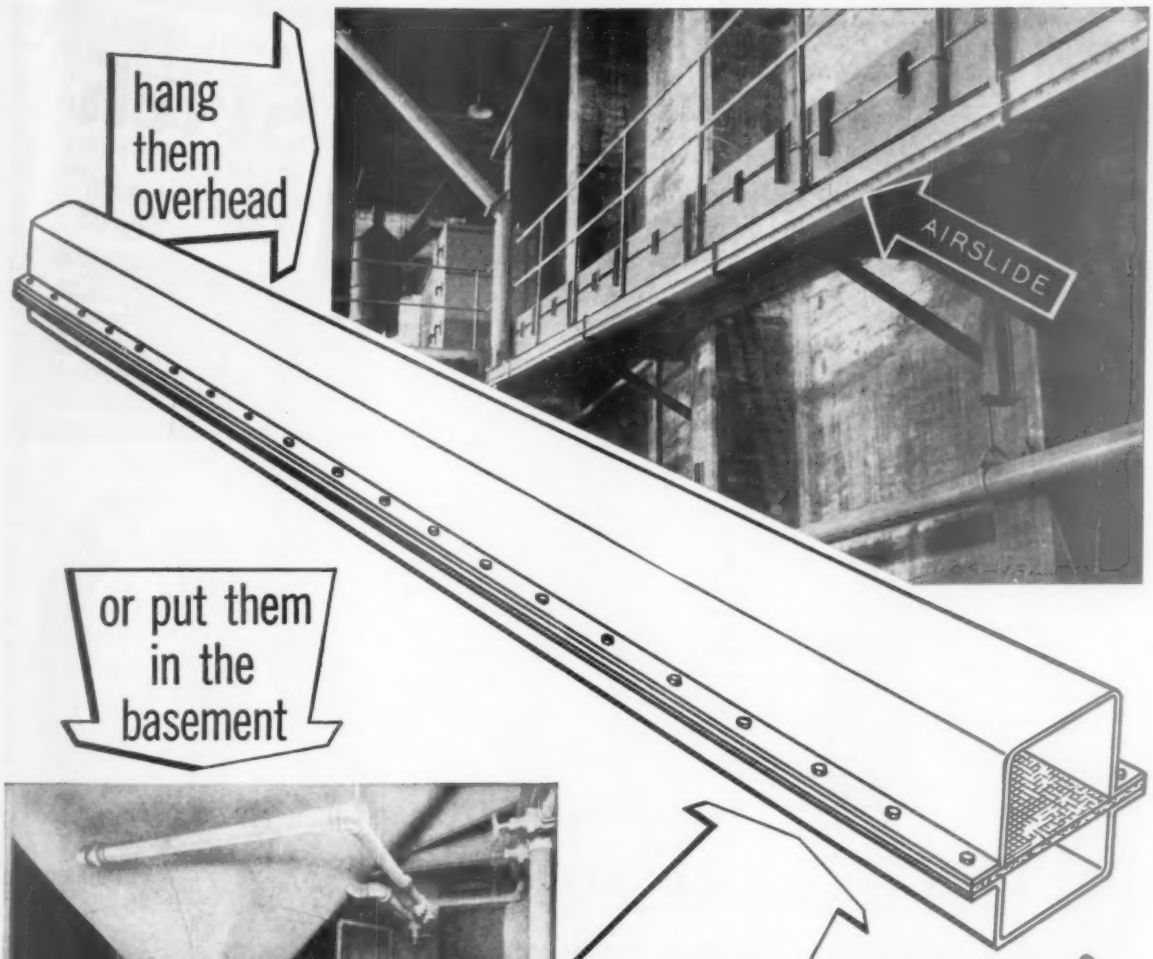
CARBORUNDUM METALS CO., INC., Niagara Falls, N.Y., has been authorized by the Atomic Energy Commission to design, build, and operate its own plant to produce zirconium, a heavy metal refined from zircon. The plant will use the abundant deposits of the zircon sand along the coastal beaches extending from the mouth of the St. John's river to Eau Gallie in Florida.

Lebanese Cement Plant

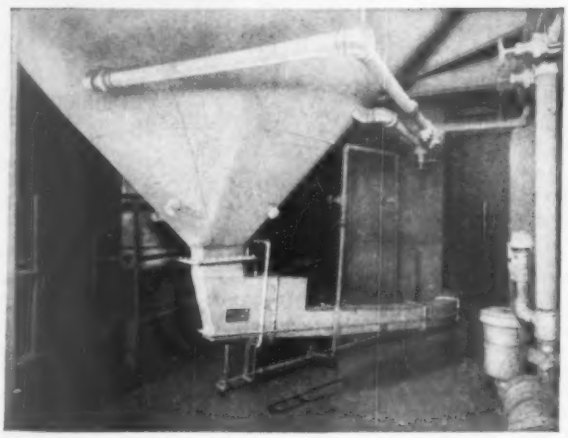
THE LEBANESE CEMENT WORKS, Chekka, Lebanon, the only cement plant in the Lebanese Republic, produced 302,652 metric tons of cement in 1951, compared with an output of 263,197 tons in 1950. Fuel oil is used for burning the slurry. A fourth kiln is presently being added which will increase annual production to over 420,000 tons.

UNIVERSITY OF MICHIGAN LIBRARIES

hang them overhead



or put them in the basement



F-H AIRSLIDE® CONVEYOR

Among the many worth-while advantages of the F-H Airslide Conveyor is the ease with which it can be designed and installed to avoid structural obstacles and production equipment; allow for much needed, valuable space in the plant.

Airslides permit economy in location without the restrictions or straight-line limitations of mechanical conveyors. Use of alternate straight and curved sections result in almost complete freedom of location, subject only to headroom requirements to allow for the proper degree of slope required for moving the material. The Airslide operates on the principle of fluidizing dry, fine materials, with low-pressure air, so that they flow by gravity, like water, on a slightly inclined plane.

Photographs shown illustrate two extreme locations. The upper view shows the Airslide, suspended overhead, from a walkway; the other located in a basement.

Airslides will convey materials such as, for example: gypsum, soda ash, fly ash, barytes, bentonite, Portland cement, cement raw material, flour, ground ores, hydrated lime, alumina, catalysts, silica, phosphates, talc, resins, detergents and soap powders, and calcined magnesite.

Why not have a Fuller engineer show you how an F-H Airslide Conveyor system can reduce the cost of conveying dry, fine materials in bulk, while it increases production efficiency. This service costs you nothing and, it may mean a step toward better production, more economically attained.

Fuller

DRY MATERIAL CONVEYING SYSTEMS AND COOLERS—
COMPRESSORS AND VACUUM PUMPS—
FEEDERS AND ASSOCIATED EQUIPMENT

FH-25

FULLER COMPANY, Catasauqua, Pa.
Chicago 3—120 S. LaSalle St.
San Francisco 4—420 Chancery Bldg.

"Fuller Company is the exclusive manufacturer of air gravity conveyors, except for use in motor vehicles, under Huron Portland Cement Company U.S. Patent Nos. 2,316,814, 2,517,837, 2,527,394, 2,527,455, 2,527,466, 2,527,488 and Patents Pending".

Specify LE-HI for all Hose Couplings!

Wherever hose is used there is a LE-HI hose coupling to match—from small tubing to large industrial applications.... The complete LE-HI line includes:

- Air Tool Couplings
- Welding Hose Couplings
- Steam Hose Couplings
- Fire Hose Couplings
- Acid Hose Couplings
- Sand and Blower Hose Couplings

SERIES 400

SERIES 650

- Drilling Hose Couplings
- Oil and Gas Hose Couplings
- Agricultural Hose Couplings

. . . plus complete lines of hose clamps, air valves and manifolds.

Sold through leading distributors and rubber manufacturers only.

"Old Doc" says: "Write now for your free copy of the complete LE-HI catalog"

HOSE ACCESSORIES COMPANY
1714 Lehigh Ave.
Philadelphia, Pa.

LE-HI Makes a Good Connection!

LE-HI
HIGH and LOW PRESSURE
HOSE COUPLINGS
TRADEMARK REGISTERED

Chief Highway Consultant

A. A. ANDERSON has been appointed chief highway consultant of the Portland Cement Association, Chicago, Ill. He was formerly manager of the Highways and Municipal Bureau and will be succeeded in this position by L. M. Arms, former assistant manager of the bureau. Mr. Anderson, a nationally known technician in the concrete paving field, joined P.C.A. in 1923 as a field engineer in Kansas. Four years later he became an associate engineer for the Highways Bureau, and in 1935 was appointed regional highway engineer. He has been manager of the Highways Bureau since 1936. He is a civil engineering graduate of Kansas State College and served as a division engineer with the Kansas State Highway Commission prior to joining the association. A member of the American Society of Civil Engineers, Mr. Anderson was awarded the Arthur M. Wellington prize for the most valuable paper on transportation presented before the society in 1950.

Mr. Arms joined P.C.A. in 1932, and in 1945 was appointed assistant manager of the Highways Bureau. He had previously served as assistant district engineer in the Illinois Highway Department and engineer of design of the Cook County Highway Department.

Adds Crushing Plant

STANDARD SLAG CO. is adding a new crushing plant to its New Boston, Ohio, operations. The new construction will double the present plant capacity. Concrete foundations are finished and all structural steel has arrived for the plant. Three new screening floors, three storage bins and a new elevator will be erected.

Canadian Potash Plant

WESTERN POTASH CORP., Toronto and Calgary, Canada, plans to complete building a potash plant at Unity, Sask., within the next 20 months. The plant would process material from Canada's only known potash deposit. The company has 120,000 acres in the Unity area under lease. The corporation reportedly has spent $250,000 on tests to determine the best method of excavation.

Phosphate

SILICA PRODUCTS CO., Elliston, Powell county, Mont., will resume development work on its phosphate property. Walter Birkland and H. C. Beck, both of Tacoma, Wash., are president and secretary of the company, respectively.

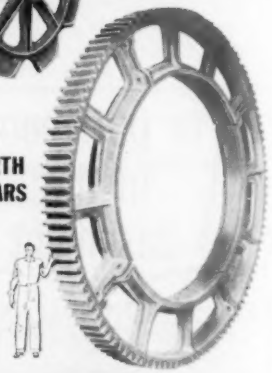
Gravel Plant Sold

THE SAND AND GRAVEL PLANT owned and operated for the past 16 years by Harold Bennett, Clermont, Iowa, has been sold to Lowell Langeman, Maynard, Iowa.

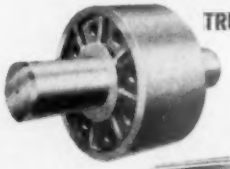
ALWAYS SPECIFY
Stroh
WEAR-RESISTANT
Replacement Parts
for
Kilns, Coolers, Dryers, Rod Mills, Tube Mills, Ball Mills, Compeb Mills, Crushers, Classifiers
other similar equipment

SPROCKETS

GIRTH GEARS



TRUNNIONS



PINION GEARS

Specialists since 1916 in the fabrication of gears, tires, trunnions, sprockets and allied parts for processing equipment . . . Stroh engineers have perfected a method of applying a high grade, wear-resistant alloy steel to the wearing surfaces only of plain carbon steel. Let us show you case studies of long service life, economy and smooth operation of equipment.

Write today!

GEARS • PINIONS • METAL TIRES • TRUNNIONS • SHEAVES • SPROCKETS • CRUSHER PARTS • RACKS AND PINIONS
CRANE WHEELS • SPINDLES • COUPLING BOXES • CRAB COUPLINGS • MILL PINIONS

Stroh PROCESS STEEL CO.
Established 1916
PITTSBURGH 12, PENNA., U. S. A.
WALLACE YOUNG, South American Representative
Manufacturers of STROH ALLOY CAST TOOTH GEARS
CAST OR CUT TOOTH CARBON STEEL GEARS

UNIVERSITY OF MICHIGAN LIBRARIES

Having trouble with this tough trio?

switch to SUPER-TEMPERED PRECISION SPACE SCREENS

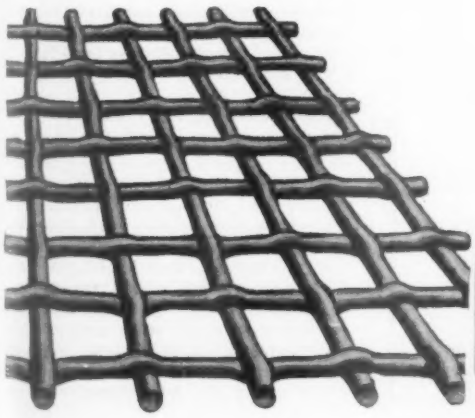
Abrasion . . . Vibration . . . Fatigue! Here's a trio of trouble-makers that can play hob with your production schedules when they team up against ordinary screens.

Want to make 'em yell quits? Just install Super-Tempered Precision Space Screens and find out what extra durability and tightness can mean to you in less downtime, longer, more accurate service, greater tonnage output at lower cost. And here's why:

- **Hard and tough steel**
- **Precision crimping**
- **Powerful looming**

To order, write or phone our nearest district sales office.

THE COLORADO FUEL AND IRON CORPORATION—Denver, Colorado
THE CALIFORNIA WIRE CLOTH CORPORATION—Oakland, California
WICKWIRE SPENCER STEEL DIVISION—Atlanta, Boston, Buffalo, Chicago, Detroit, New York, Philadelphia



SUPER-TEMPERED
PRECISION SPACE SCREENS
PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION
CF&I

CRANE WHEELS • SPINDLES • COUPLING BOXES • CRAB COUPLINGS • MILL PINIONS

SLY PIONEERS & LEADERS in INDUSTRIAL DUST CONTROL

Typical Sly Dust Filter in a cement plant

In April 1948, a leading cement manufacturer installed an automatic-continuous Sly Dust Filter to ventilate four cement finish mills.

This filter is responsible for saving approximately $100, or 50 barrels of cement per 24-hour day. It has been in operation since installation without repairs.

This is a typical example of how Sly Dust Filters repay their cost.

Tell us your dust problem and let us estimate what *you can save.*

THE W. W. SLY MANUFACTURING CO.
4746 TRAIN AVENUE • CLEVELAND 2, OHIO
Branches in:
NEW YORK • CHICAGO • PHILADELPHIA • SYRACUSE • DETROIT • BUFFALO
CINCINNATI • ST. LOUIS • MINNEAPOLIS • BIRMINGHAM • LOS ANGELES
TORONTO

Slurries...*handled at lower cost*

The new WILFLEY MODEL K Centrifugal Sand Pump embodies important mechanical improvements especially adapted to the handling of cement slurry and results in stepped-up production and substantial power savings. Individual engineering. Write for details.

Buy WILFLEY for Cost-Saving Performance

A. R. WILFLEY & SONS, Inc.
Denver, Colo., U.S.A.
New York Office: 1775 Broadway, N.Y.C.

WILFLEY centrifugal PUMPS

KEEP ABREAST WITH INDUSTRY TRENDS THROUGH ROCK PRODUCTS

California Geologic Report

THE CALIFORNIA DIVISION OF MINES recently announced the publication of Bulletin 161, which contains "The Geology of the Healdsburg Quadrangle," by William Kelso Gealey, and "The Mineralogy of the California Glaucophane Schists," by George Switzer.

The Healdsburg quadrangle covers a region in the northern Coast Ranges which includes a section of the Russian River in Sonoma county. Many types of sedimentary and igneous rock are said to be found within the quadrangle.

The minerals described are said to be distinctive of the California Coast Ranges province. Sand and gravel, crushed stone and quicksilver are produced commercially, while other valuable rocks and minerals occur in amounts too small for commercial uses.

The report is accompanied by a detailed geologic map printed in color. Illustrations, photographs and charts are also included. Copies may be obtained from the California State Department of Natural Resources, Division of Mines, Ferry Building, San Francisco 11, Calif.

Perlite Institute Moves

PERLITE INSTITUTE has announced the removal of its offices from 35 W. 53rd St., New York City, to Room 1210, 10 E. 40th St., New York 16, N.Y.

Quake Hits Cement Plant

MONOLITH PORTLAND CEMENT CO., Los Angeles, Calif., temporarily stopped operations at Monolith, Calif., following southern California's recent earthquake. Officials made the decision to stop operations because they feared the aftershock quakes might have increased the damage to the plant to a point of danger. One kiln was slightly damaged.

Mica

TOE RIVER MICA CO., Spruce Pine, N.C., has obtained a certificate of incorporation from the North Carolina secretary of state to mine, process and sell mica and other minerals. The firm has authorized capital stock of $100,000. The incorporators are H. T. Barksdale, James Carpenter, D. E. Collis and others.

Opens New Quarries

EVERETT & CLARK, Plattsburg, Mo., recently opened two new quarries near Wathena, Kan., bringing to 11 the number of quarries operated by the company. The two new quarries are located on opposite ends of the newly acquired property and the same equipment will serve both quarries. A small house on the property is being converted into an office and weighing station. Plant equipment includes a shovel, crusher, power generating plant and three bulldozers.

UNIVERSITY OF MICHIGAN LIBRARIES

FINANCIAL

RECENT DIVIDENDS

Alpha Portland Cement Co.	$0.50	Sept. 10
Lehigh Portland Cement Co.—Q	0.30	Sept. 2
National Gypsum Co.—$4.50 pf.—Q	1.12½	Sept. 2
Penn-Dixie Cement Corp.—Q	0.40	Sept. 15
Potash Co. of America—Q	0.45	Sept. 1
Potash Co. of America—Yr. E	0.45	Sept. 1
Superior Portland Cement, Inc.—Q	0.25	Sept. 10
U.S. Gypsum Co.—Q	1.00	Oct. 1
U.S. Gypsum Co.—pf. Q	1.75	Oct. 1
U.S. Gypsum Co.—E	1.50	Oct. 1

NORTH AMERICAN CEMENT CORP., New York, N.Y., has reported a net income of $849,446 for the year ended June 30, 1952, compared with a net income of $1,179,746 for the preceding year.

LONE STAR CEMENT CORP., New York, N.Y., for the six months ended June 30, has reported its consolidated earnings as follows:

	1952	1951
Sales	$39,182,999	$33,697,205
Mfg., etc., costs	22,075,939	18,721,988
Selling, etc., expenses	2,715,672	2,559,538
Deprec. & deplet.	2,690,135	1,293,214
Operating profit	11,701,253	11,122,465
Other income	394,806	342,415
Total income	12,096,059	11,464,880
Misc. charges	957,660	645,196
Other taxes	1,260,670	1,027,497
Foreign exch. res.	200,000	98,000
Federal income tax	3,885,000	4,400,000
Excess profits tax	675,000	900,000
Other income tax	937,041	861,025
Net profit	4,180,688	3,533,162
Earned, com. share	$1.47	$1.24
No. of com. shares	2,845,791	2,845,791

UNITED STATES GYPSUM CO., Chicago, Ill., for the six months ended June 30, has given the following statement of income:

	1952	1951
Net sales	$88,122,333	$97,562,915
Cost of sales	52,797,943	58,428,334
Selling, etc., expenses	8,804,778	8,624,570
Deprec. & deplet.	2,439,079	2,564,527
Net earnings	24,080,533	27,945,484
Securities income	604,540	459,813
Other income, net	512,102	109,213
Total income	25,197,175	28,514,510
Income taxes	13,227,000	14,353,000
Excess profits tax	2,370,000	3,622,000
Net income	9,600,175	10,539,510
Earned surp., 1-1	95,119,685	87,045,242
Preferred divs.	273,777	273,777
Common divs.	3,199,574	3,199,504
Earned surp., 6-30	101,246,509	94,111,471
Earnings pfd. share	$122.73	$134.74
No. of pfd. shares	78,222	78,222
Earnings, com. share	$5.83	$6.41
No. of com. shares	1,599,787	1,599,787

WARNER CO., Philadelphia, Penn., has reported the following statement of earnings for the six months ended June 30:

	1952	1951
Gross sales	$9,719,102	$10,694,149
Income before income taxes	2,019,747	2,556,060
Provision for income taxes	982,000	1,418,500
Net income	1,037,747	1,137,560
Number of common shares	474,329	474,329
Earnings per share	$2.18	$2.39

LEHIGH PORTLAND CEMENT CO., Allentown, Penn., has reported the following statement of earnings for the six months ended June 30:

	1952	1951
Sales	$24,897,321	$23,909,526
Net before taxes	6,178,378	6,917,638
Federal income tax	3,699,000	4,290,000
Net profit	2,479,378	2,627,638
Earned, com. share	$1.30	$1.38
No. of com. shares	1,901,560	1,901,560

NORTH AMERICAN REFRACTORIES Co., Cleveland, Ohio, lists a net profit of $241,950, or $1.22 per common share on 198,457 shares, for the first six months of 1952, which compares

IMPROVE RESULTS THE SAUERMAN WAY!

Aggregate producers, cement, lime and gypsum mills and many processors of ores and chemicals find that jobs of handling materials can be simplified and big savings made by using either a Sauerman Cableway or a Sauerman Drag Scraper.

These machines are able to span a large area and move material rapidly from point to point anywhere within that area, dumping automatically at any required spot. The first cost of a Sauerman machine is reasonable, maintenance amounts to very little, and the simplicity of operation makes it possible to place the control of even the largest installation in the hands of one operator.

Almost any dig-and-haul project can be handled economically with the correct size and type of Sauerman machine. Tell us about your problem and you will receive, without obligation, advice based on the 42 years' experience of Sauerman engineers.

The Story Behind the Picture

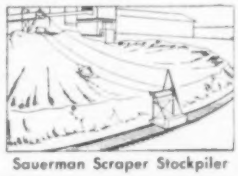
•

Using two 2-cu. yd. Crescent scrapers operating on long stock-piles at an angle from each other, the Sauerman scraper machine pictured above has given satisfaction since 1926 at the crushing plant of Wm. P. McDonald Corp. at Brooksville, Fla. Its 25-year record shows very small expense for repairs.

•

Write today for the Sauerman Catalog

Sauerman Scraper Excavator


Sauerman Scraper Stockpiler

Sauerman Slackline Cableway

SAUERMAN BROS., INC.

530 S. Clinton St. Chicago 7, Illinois

MANGANESE STEEL CASTINGS

for PULVERIZERS CRUSHERS ROLLS SCREENS

for SHOVELS DREDGES CRANES CONVEYORS

The Frog, Switch & Mfg. Co.

Established 1881 CARLISLE, PA.

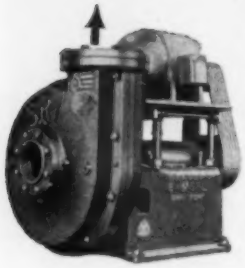
Denver "Sub-A" Flotation

Denver Cross-Flow Classifiers

Denver Hydroclassifiers

Denver Super-Agitator and Conditioners

Lower Cost Pumping IS possible with DENVER SRL... Rubber Lined Pump



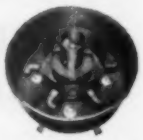
Here's Why...

Power cost is 30% to 70% *less* than for other sand pumps on similar service. *REASON:* greater hydraulic efficiency resulting from simple design, rubber parts and lighter weight. Accuracy of rubber parts results in 1½ to 3 times greater efficiency than other sand pumps.

Learn More About Actual Savings

If you pump –⅛" abrasives, describe your pumping requirements. Let us study and report specific advantages of Denver SRL Pumps over pumps you now use. Write Today!

Denver Disc Filters



Denver Pulp Distributor

Examples of DENVER SRL Rubber Lined Pump Curves*

Size	Gals. of water per minute		20′ head	40′ head	60′ head	80′ head	100′ head
2″x2″ SRL	50	RPM	838	1090	1320	1525	
		HP	.60	1.5	2.8	3.2	
3″x3″ SRL	100	RPM	760	1053	1303	1453	
		HP	1.1	1.9	3.4	4.3	
5″x5″ SRL	300	RPM	590	800	956	1087	
		HP	2.4	5.4	8.3	11.5	
6″x6″ SRL	1000	RPM		862	1005	1122	
		HP		14.4	22.6	30.0	
3″x3″ SRL-C	150	RPM	870	1145	1385	1580	1745
		HP	1.5	3.2	5.3	7.2	9.6
5″x4″ SRL-C	350	RPM	655	850	1020	1160	1280
		HP	2.9	5.4	8.3	11.4	14.5
8″x6″ SRL-C	800	RPM	500	655	780	890	980
		HP	5.7	11.6	16.8	22.3	28.6
10″x8″ SRL-C	2000	RPM	485	610	710	800	855
		HP	14.0	27.8	41.2	56.3	71.6

(*Multiply these horsepower ratings by the specific gravity of your pulp to determine actual brake horsepower required.)

Denver Thickeners

Denver Reagent Feeders

FLOTATION ENGINEERS

"The firm that makes its friends happier, healthier, and wealthier"

DENVER EQUIPMENT COMPANY

P.O. BOX 5268 • DENVER 17, COLORADO

DENVER • NEW YORK CITY • CHICAGO • EL PASO • TORONTO • VANCOUVER • MEXICO CITY • LONDON • JOHANNESBURG

T.C.

WOVEN WIRE SCREENS

ACCURATE • DURABLE • ECONOMICAL

The reliability of T.C. Alloy Screens has carried them into all parts of the world. Made in Standard and Special Weaves, with Square or Oblong Openings – from 10 mesh, .035" wire on up. Write today for Catalog No. 42.

TWIN CITY IRON & WIRE CO.

25 W. WATER STREET • ST. PAUL 1, MINNESOTA

ROCK PRODUCTS NEWS EACH ISSUE

with a net profit of $425,210, or $2.14 per share, for the first six months of 1951. Net sales for the six months ended June 30, 1952, amounted to $5,263,934, as against $6,284,460, for the corresponding period of the previous year.

PACIFIC COAST AGGREGATES, INC., San Francisco, Calif., for the three months ended June 30, 1952, has reported a net profit of $258,892, or $21.39 per preferred share on 12,103 shares, and $0.33 per common share on 736,962 shares. This compares with a net profit of $249,878, or $19.17 per preferred share, on 13,033 shares, and $0.32 per common share on 736,967 shares, for the same three months of 1951. Net sales for the 1952 quarter totaled $3,767,274, as against $4,609,192 for the corresponding quarter of 1951.

PEERLESS CEMENT CORP., Detroit, Mich., lists a net profit of $484,741 for the first six months of 1952, compared with a net profit of $655,544 for the same six months of 1951. This amounted to $1.56 per common share on 310,062 shares for the 1952 period, as against $2.11 per share for the 1951 period.

GENERAL PORTLAND CEMENT CO., Chicago, Ill., for the six months ended June 30, reports the following statement of income:

	1952	1951
Net sales	$14,712,100	$13,236,900
Cost & exp.	8,476,700	7,513,800
Operating profit	6,235,400	5,723,100
Other income, net	dr 223,200	11,400
Total income	6,012,200	5,734,500
Federal income tax	3,121,000	2,908,000
Excess profits tax	724,000	623,000
Net profit	2,167,200	2,203,500
Earned com. share	$2.08	$2.12
No. of com. shares	1,039,971	1,039,971

ALPHA PORTLAND CEMENT CO., Easton, Penn., for the year ended June 30, has reported the following statement of earnings:

	1952	1951
Net sales	$24,329,241	$24,052,590
Costs & exp.	17,226,125	16,117,472
Deprec. & deplet.	861,426	744,117
Oper. profit	6,241,790	7,191,001
Other income, net	120,878	124,595
Total income	6,362,668	7,315,596
Federal income tax	3,386,646	3,221,009
Excess profits tax	775,368	566,140
Net profit	2,200,654	3,528,447
Prev. surplus	9,761,170	8,168,798
Common divs.	1,467,390	1,936,075
Surplus, June 30	10,494,434	9,761,170
Earn. com. share	$3.75	$6.01
No. com. shares	586,956	586,956

CONSOLIDATED CEMENT CORP., Chicago, Ill., has reported a net profit of $30,800, or $0.31 per class A share, on 99,916 shares, for the first six months of 1952. This compares with a net profit of $193,400, or $1.94 per class A share, for the corresponding period in 1951. Net sales amounted to $1,958,100 for the 1952 period, as against $2,290,800 for the first six months of the preceding year.

ZONOLITE CO., Chicago, Ill., for the year ended March 31, 1952, lists a net profit of $445,436, or $0.45 per common share, on 984,112 shares, compared with a net profit of $775,905, or $0.79 per share, for the preceding year. Net sales for the year ended in 1952, totaled $5,978,025, as against $6,270,063 for the previous year.

UNIVERSITY OF MICHIGAN LIBRARIES

MANUFACTURERS NEWS

Blaw-Knox Co., Pittsburgh, Penn., has announced the appointment of George L. Dirks as general manager of the Blaw-Knox division, Blawnox, Penn. He succeeds D. V. Sherlock, who returned from retirement to serve temporarily as acting general manager of the division. Mr. Dirks was formerly general manager of the Canadian division of Yale & Towne Mfg. Co. at St. Catharines, Ontario.

Allis-Chalmers Mfg. Co., Milwaukee, Wis., announces that the board of directors of LaPlant-Choate Mfg. Co., Inc., Cedar Rapids, Iowa, has approved an agreement and plan of reorganization with Allis-Chalmers. Under the plan Allis-Chalmers common stock will be exchanged with LaPlant-Choate common stockholders on the basis of one share of A-C common for each five shares of LaPlant-Choate common.

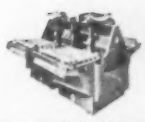
International Paper Co., New York, N.Y., announces that J. H. Friend has resigned as vice-president of International Paper Co. and as general manager of its Southern Kraft division. However, he will continue to serve on the board of directors and in a consultant capacity. Mr. Friend will be succeeded as general manager of the division by Erling Riis, vice-president and assistant general manager.

The White Motor Co., Milwaukee, Wis., announces that Lee E. Copple has been named sales manager of the construction and mining equipment department of the Sterling division. He was formerly off-highway tire sales manager for Firestone Tire & Rubber Co.

Nordberg Mfg. Co., Milwaukee, Wis., has announced the appointment of Admiral A. G. Noble, USN, (retired), as executive vice-president, a member of the executive committee and a member of the board of directors. He was formerly vice-president and general manager of Martin-Parry Corp., Toledo, Ohio. A native of Texas, Admiral Noble entered the Naval Academy in 1913, and retired from the Navy in 1951. He has a master's degree in mechanical engineering from Massachusetts Institute of Technology. Prior to his retirement, Admiral Noble served in the Naval Department as Chief of Naval Material, where he had been in general charge of the entire Navy procurement program, and prior to that as chief of the Bureau of Ordnance.

Admiral A. G. Noble

Sterling Electric Motors, Inc., Los Angeles, Calif., has appointed Herbert F. Ziegler, Jr., as manager of the Kansas City, Mo., district office. The company has also appointed the

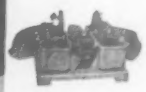


Denver "Sub-A" Coal Flotation Machine

Denver Disc Filters

Denver Hydroclassifiers

Denver Super-Agitator and Conditioners



Denver Reagent Feeders

Denver Pulp Distributor

Improperly Engineered Dryers Result in Low Drying Efficiencies or Lost Dollars to Your Company!

DENVER STANDARD DRYERS are engineered to meet **YOUR EXACT REQUIREMENTS** by men who know the drying business.

Preliminary estimates on the type and size **DENVER STANDARD DRYER** required to most efficiently dry your material will be submitted promptly without charge or obligation.

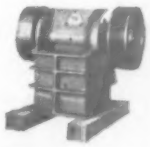
No drying operation too small; too large; too simple or too complex.

DELIVERIES. Our selling prices are competitive and yet we make excellent deliveries—usually better than 4 months on small and large units.

Write for: Descriptive bulletins on **DENVER STANDARD DRYERS.** Write Today!

Many of our machines are in stock.

Denver Thickeners



Denver Jaw Crushers

FLOTATION ENGINEERS

"The firm that makes its friends happier, healthier, and wealthier"

DENVER EQUIPMENT COMPANY

P.O. BOX 5268 • DENVER 17, COLORADO

DENVER • NEW YORK CITY • CHICAGO • EL PASO • TORONTO • VANCOUVER • MEXICO D.F. • LONDON • JOHANNESBURG

GREATER READER SERVICE MAKES ROCK PRODUCTS THE FAVORITE PUBLICATION OF YOUR INDUSTRY

Over 15,000 men in the industry subscribe to Rock Products.

Why? . . . Because Rock Products helps these men, month by month, do a better, more economical, more profitable job. Such regular features as *Hints and Helps, Association News, News of the Industry,* as well as complete, full-length features on the industry's newest, most modern plants make Rock Products the favorite of the industry . . . every month.

Join this family of progressive, industry leaders today by sending your subscription order . . .

Two years, $3
One year, $2

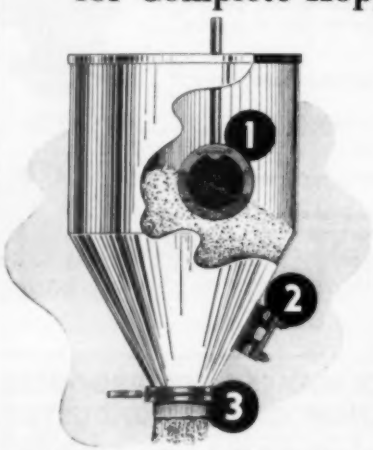
Rock Products

309 West Jackson Blvd.
Chicago 6, Ill.

You'll beat the drum for Hudson, too, when you soon see the announcement from this fully integrated mill.

HUDSON PULP & PAPER CORPORATION
Dept. 111, 505 Park Avenue, New York 22, N. Y.

for Complete Hopper Efficiency—



SYNTRON

1. Hopper Level Switches

Eliminate spillage and shortage of materials. Automatically maintain desired levels of materials — from fine to coarse—in bins and hoppers. Control feeding.

2. Electric Vibrators

Assure free-flowing bins, hoppers and chutes. Eliminate arching and plugging of materials without hammering and rodding that damages equipment and wastes manpower.

3. Flow Control Valves

Control flow of bulk materials from bins, hoppers and chutes. Rotating control lever increases or decreases opening of flexible iris type diaphragm and flow of material without jamming or clogging.

Write For FREE Illustrated Folders

SYNTRON COMPANY
450 Lexington Avenue Homer City, Penna.

following distributors: Cascade Industrial Supply, Inc., Klamath Falls, Ore.; Selma Foundry & Machine Co., Selma, Ala.; W. A. Wilson Corp., New York, N.Y.; Roger Brown Co., El Paso, Texas; Herr Electric Co., Baltimore, Md.; Story Electric Motor Repair Co., Little Falls, N.J.; and Woodbury & Co., Portland, Ore.

Boston Woven Hose & Rubber Co., Cambridge, Mass., has announced the appointment of Whiting N. Shepard as director of sales. He was formerly head of plastics sales.

Pioneer Engineering Works, Inc., Minneapolis, Minn., announces that Eugene C. Bauer, Jr., first vice-president of Kensington Steel Co., Chicago, has been elected a director of Pioneer Engineering Works. He succeeds Philip W. Moore, formerly president of Poor & Co., who has resigned because of ill health. Pioneer Engineering Works and Kensington Steel Co. are subsidiaries of Poor & Co.

Kraft Bag Corp., New York, N.Y., announces the appointment of James M. Gager, Jr., as sales representative in Tennessee, Georgia, South Carolina and part of North Carolina, with headquarters in Chattanooga, Tenn.

Straub Mfg. Co., Inc., Oakland, Calif., has appointed Miller Machinery Co., Missoula, Mont., as sales representative for Kue-Ken crushers in Montana west of Livingston, also the counties of Lemhi, Custer, Valley, Butte, Blaine and Clark in Idaho. Additional territory on a non-exclusive basis includes the rest of Montana and southern Idaho.

Caterpillar Tractor Co., Peoria, Ill., has announced completion of two new buildings at Joliet, Ill. One is for jigs and fixtures and the other for reclamation purposes.

Fairbanks, Morse & Co., Chicago, Ill., announces that W. E. Watson, formerly manager of the pump manufacturing division, has been promoted to assistant to the manager of manufacturing, with headquarters in Chicago. Paul R. Flood, who has been manager of manufacturing at the Beloit works, has been transferred to Pomona, Calif., as general manager of the Pomona pump works, succeeding Charles L. Barrett who has become a consultant to the pump division. Lewis H. Kessler has been named chief hydraulic engineer at the Beloit works. He succeeds R. C. Glazebrook who is on special assignment to the general manager in connection with the new plant now under construction in Kansas City, Mo. Robert B. Craig, formerly R.E.A. deputy administrator and Diesel Engine Manufacturers Association representative, has been appointed assistant to the president with headquarters in Washington, D.C. S. L. Fry, formerly manager of the Omaha branch diesel department, has been appointed assistant manager of the pump sales division in Chicago.

The Jeffrey Mfg. Co., Columbus, Ohio, announces that Carl Verhine of the Columbus office has been trans-

UNIVERSITY OF MICHIGAN LIBRARIES

ferred to the Milwaukee sales staff; J. A. Lowry has been moved from New York to Columbus; and Elmer Longnecker has been transferred from the Columbus district office to Detroit, replacing Robert Monsarrat who has been named manager of the Philadelphia district office.

New York Belting & Packing Co., Passaic, N.J., has announced the appointment of John C. Durbin, Jr., as factory sales representative in Washington, Oregon and Idaho, with headquarters in Portland, Ore. He was formerly associated with the San Francisco staff.

Raybestos-Manhattan, Inc., Passaic, N.J., has announced opening of a new office and warehouse in Denver, Colo., to serve the Rocky Mountain and western Canadian regions. Elton T. Fair, Jr., sales representative for the territory, is in charge of the new warehouse.

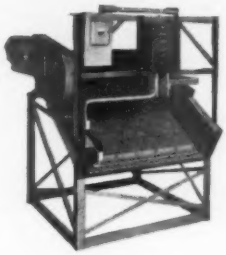
International Paper Co., New York, N.Y., announces opening of a new Bagpak division sales office in Kansas City, Kan., headed by O. W. McDuffie.

Thermoid Co., Trenton, N.J., has appointed Lester J. Hyland as sales manager of the industrial rubber division, with headquarters at Trenton. He was formerly manager of the western division, industrial rubber products, at San Francisco, Calif. Robert Gentles, formerly district sales representative in San Francisco, has been named to succeed Mr. Hyland as western division manager.

Worthington Corp., Harrison, N.J., announces the death of Thomas Cruthers, vice-president. A graduate of Stevens Institute of Technology, Mr. Cruthers had been associated with the company since 1907.

Chase Bag Co., Chicago, Ill., announces that George K. Whyte, formerly sales manager in St. Louis, has been appointed manager of the St. Louis factory and sales office.

Gar Wood Industries, Inc., Wayne, Mich., has announced the appointment of F. Eugene Englander as sales manager of the Richmond division, Richmond, Calif. He was formerly sales manager of Oscar Krenz, Inc., Berkeley, Calif.



For Ag-Lime or Other Tough Fine Screening... FlexElex Plus Leahy Snap-Action Assures Low Cost Production

By keeping the mesh of the screen cloth wide open for maximum capacity at all times, the FlexElex equipped Leahy so substantially steps up production in screening damp fines that production costs nose-dive.

This achievement is made possible by (a) differential snap action that frees the mesh of intermediate size wedging particles and (b) electrically heated wires that avoid build-up and eventual blinding by damp fines.

Hand beating of screen cloth is eliminated, multiplying the useful life of the jacket assembly. Production records are astounding even experienced engineers. For complete information, ask for Bulletin 15-J.

The DEISTER CONCENTRATOR COMPANY

The Original Deister Company, Incorporated 1906

915 Glasgow Avenue, Fort Wayne, Indiana

CONCENTRATION PRODUCTS

HAUCK
Heaters & Thawers
Eliminate Winter Freeze-Ups and Delays

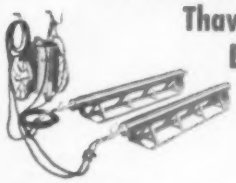
Combination Concrete Heater and Thawer
Introduces clean heat right into concrete mixer drum. Burner clamps on mixer; can also be used as thawing burner.

Thawing Burners

For hopper cars, concrete forms, stone, sand and gravel piles. Heavy duty burners with welded steel fuel tanks—deliver large, intense flame; save time and labor.

Water Heaters
Heat large quantities of water quickly for concrete mixers and central mixing plants.

Portable Hopper Car Thawing Tube Equipment



Thaws sand, gravel, cinders quickly for dumping. Powerful, smokeless heating flame. Fuel oil-burning compressed air type and kerosene-burning hand pump type.

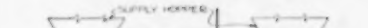
Write for Catalogs

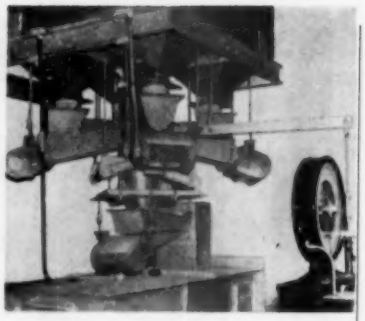
HAUCK MANUFACTURING CO.
137-147 Tenth St., Brooklyn 15, N. Y.

SYNTRON

"Automatic"

Batch Weighing





Provides

ACCURACY OF BATCH

SIMPLE CONTROL

SELECTIVITY

—start working with the push of a button.

Vibrators on bins and hoppers keep the materials free-flowing. The Vibratory Feeders automatically filling scale hoppers to exact weight and discharging onto secondary Vibratory Feeders, smoothly emptying each accurately weighed batch into mixers, blenders, belt conveyors, etc.

Any one, or a combination of any number of materials may be batched, accurately and automatically, at the same time.

Write Today For FREE Illustrated Catalog Folder 'BW'

SYNTRON COMPANY

450 Lexington Avenue Homer City, Penna.

"YOU'LL GET ALL FIVE WITH..."

CLEVELAND WIRE SCREENS

Here are the five qualities essential to satisfactory, long-life Vibrating Screen Section operation . . . they mean *more tonnage* and *less down-time*. Cleveland Wire Screens offer you all five . . . why accept less?

- TOUGHNESS AND DUCTILITY
- LONGER PRODUCTIVE SERVICE
- REDUCTION OF "BREAKS" IN SCREEN
- BUILT AND DESIGNED WITH EXPERIENCED "KNOW HOW"
- RIGID ACCURACY OF OPENINGS MAINTAINED CONTINUOUSLY

Write today for Bulletin No. 6

THE CLEVELAND WIRE CLOTH & MFG. CO.

3576 E. 78th STREET • CLEVELAND 5, OHIO

Davey Compressor Co., Kent, Ohio, has appointed George E. Jennings as West Coast district manager, with headquarters in San Francisco. He will be in charge of operations in California, Oregon, Washington, the cities of Reno and Carson City, Nevada; Yukon Territory, Alaska; and the province of British Columbia, Canada.

Hewitt-Robins, Inc., Stamford, Conn., announces that Austin Goodyear, general manager of the rubber and conveyor divisions, has been elected a director of the company.

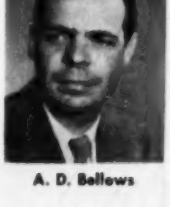
Hyster Co., Portland, Ore., announces that John Pearson has been appointed district representative in the Peoria, Ill., office. He was formerly with Cole Draft Governor Co. of Portland, Ore.

Poor & Co., Chicago, Ill., announces that Christian E. Jarchow has been elected a director of the company to fill the vacancy created by the recent death of Averill Tilden. Mr. Jarchow is executive vice-president and comptroller of the International Harvester Co.

Cummins Engine Co., Inc., Columbus, Ind., announces that J. C. Miller, formerly manager of research and refinement, has been appointed executive engineer in charge of all product engineering and research activities. D. B. Worth has been named manager of field quality. He was formerly manager of product engineering. N. M. Reiners succeeds Mr. Miller as manager of research and refinement. He had been manager of the research laboratory.

Bucyrus-Erie Co., South Milwaukee, Wis., has appointed the Brown-Bevis-Industrial Equipment Co., Los Angeles, Calif., as distributor in Los Angeles and Orange counties.

Austin-Western Co., subsidiary of Baldwin-Lima-Hamilton Corp., Aurora, Ill., announces that A. D. Bellows, formerly crusher sales engineer for Austin-Western, has been appointed sales manager, crusher department, construction equipment division, Baldwin-Lima-Hamilton, Corp., Lima, Ohio. Mr. Bellows has had about ten years of crusher sales and engineering experience with the A-W crusher division, which has been moved to the Lima plant as a result of the recent consolidation with Baldwin-Lima-Hamilton Corp.



A. D. Bellows

Caterpillar Tractor Co., Peoria, Ill., has announced the appointment of Delmar R. Lammers as service manager to assist in general service administration. He was formerly eastern division service manager and will be succeeded in this position by Merle W. Dargel, formerly service engineering manager. Theodore M. Fahnestock, who was recalled to service

UNIVERSITY OF MICHIGAN LIBRARIES

in 1950 and recently returned from Germany from active duty as captain with the 403rd Engineer Base Depot, succeeds Mr. Dargel as service engineering manager.

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has organized a field group under the direction of C. W. Schweers, vice-president and director of sales, to handle service, repairs, breakdowns, and adjustments in the field. Regional service supervisors are: A. S. Hill, Cleveland, central region; D. T. Thomas, New York, Empire region; C. P. Suykerbuyk, Atlanta, southeast region; E. G. Kime, Dallas, southwest region, and D. W. Seagrave, San Francisco, Pacific region.

Fruehauf Trailer Co., Detroit, Mich., has announced the retirement of R. L. Vaniman, vice-president in charge of export.

American Wheelabrator & Equipment Corp., Mishawaka, Ind., has appointed Walter S. Schamel as district manager of the Los Angeles office. He was formerly assistant technical director in the Mishawaka office.

Davey Compressor Co., Kent, Ohio, has announced the appointment of Jack W. Kiddy as east-central district manager for northern Ohio, Michigan (except the northern peninsula), western New York, northwestern Pennsylvania, and the province of Ontario, Canada, with headquarters in Kent.

Electric Machinery Mfg. Co., Minneapolis, Minn., has opened a new sales office at Harrisburg, Penn., with Richard C. Clark as manager.

Dodge Division, Chrysler Corp., Detroit, Mich., has appointed William S. Woolsey as director of truck sales. He has been assistant director since 1950 and succeeds L. F. VanNortwick, who has resigned to enter a Dodge dealership.

Union Bag & Paper Corp., New York, N.Y., announces the appointment of E. T. Nelson as assistant western district sales manager for multiwall bags, with headquarters in Chicago. He was formerly a field representative for multiwall bag sales in the Minneapolis area.

Worthington Corp., Harrison, N.J., has inaugurated a new placement program for recruiting and training college-graduated engineers. The program is part of the personnel and training department and covers training, education and development of new technical personnel for all branches of the company, including sales, manufacturing, accounting, purchasing and engineering.

Koppers Co., Inc., Pittsburgh, Penn., has announced the appointment of A. B. Fisher, Jr., as a vice-president in the engineering and construction division. He was formerly operating manager of the Freyn engineering department and will be succeeded in this position by F. W. Rys, formerly assistant sales manager. Arthur J. Whitcomb, manager of specialty sales, succeeds Mr. Rys as assistant sales manager, and W. C. Schofield, formerly chief engineer and assistant prod-

LAND QUICK!
HUDSON IS MAKING AN AMAZING ANNOUNCEMENT ABOUT MULTIWALLS

You'll like this down-to-earth offer, too, from Hudson, the manufacturer of multiwall sacks who covers every step from tree to finished sack.

HUDSON PULP & PAPER CORPORATION
Dept. 111, 505 Park Avenue, New York 22, N. Y.

The MODERN WAY TO MOVE MATERIALS

INDUSTRIAL HANDLING BY BRECO

Breco Ropeways are renowned throughout the world as the best, modern method for speedy, efficient and economical handling of materials in a wide variety of industries. From the heart of great cities to tropical jungles Breco Ropeways constantly prove their adaptability and versatility under the most adverse conditions. Breco engineers and technical staff have specialized knowledge in every type of application. They will be pleased to offer specific recommendations for any installation.

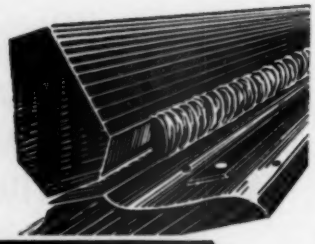
BRECO ROPEWAYS

Canadian and U.S. Agents
VULCAN IRON & ENGINEERING LTD.
Winnipeg, Manitoba
Sales Office: Edmonton

BRITISH ROPEWAY DIVISION OF
VULCAN IRON ENGINEERING LTD.
132 Jarvis St., Toronto: Phone WA. 4220

British Ropeway Engineering Co. Ltd., Plantation House, Mincing Lane, London E. C. 3, England.

TRACTOR SHOES LAST
LONGER . . . COST LESS
When You . .
Repair Worn
TRACTOR
GROUSERS
with . . .



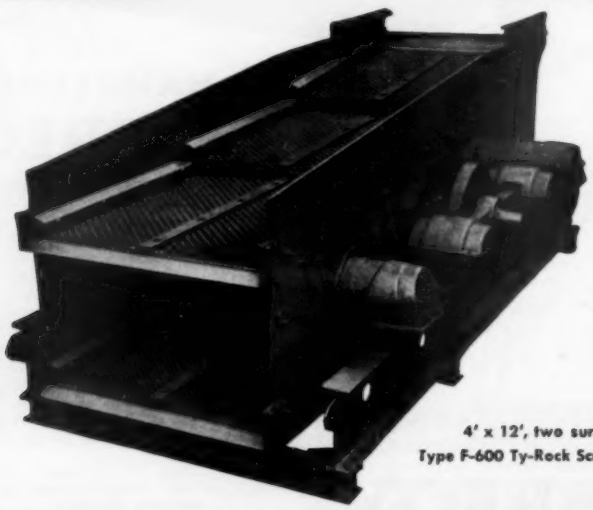
MANGANAL
U.S. Patents 1,876,738—1,947,167—2,021,945
11%-13½% Manganese-Nickel Steel
SPECIAL SHAPE
APPLICATOR BARS

- Workharden to 550 Brinell. Tensile strength to 150,000 p.s.i.
- Provide stronger, longer-lasting replacements —cost less than new parts.
- Practically eliminates build-up welding.
- Easily fabricated hot or cold without injury to metal.
- Outlast other steels due to its extreme toughness and high resistance to impact and abrasive wear.

FREE
booklet on the newest methods of economical repairs to TRACTOR SPROCKETS, ROLLERS, IDLERS, BLADES, CORNER BITS.
NEAREST DISTRIBUTOR UPON REQUEST

STULZ-SICKLES CO.
SOLE PRODUCERS 92 N. J. RAILROAD AVE. NEWARK, N. J.

YOU CAN DEPEND ON
TY-ROCK SCREENS
BALANCED RUGGED



4' x 12', two surface
Type F-600 Ty-Rock Screen

THE W. S. TYLER COMPANY
CLEVELAND 14, OHIO
Manufacturers of Woven Wire Screens and Screening Machinery

uct manager, succeeds Mr. Whitcomb as manager of specialty sales.

Raybestos-Manhattan, Inc., Passaic, N.J., has opened a new warehouse in Houston, Texas, in charge of M. C. Nugent. Announcement has also been made of the appointment of Wester-Robinson Machinery & Supply Co., Inc., as distributor in the Tacoma, Wash., area.

The Howe Scale Co., Rutland, Vt., announces that Donald P. Berne, formerly sales representative at Cincinnati, has been promoted to manager of the Minneapolis branch, with headquarters at Minneapolis, and that William J. Tucey has been appointed San Francisco branch manager, succeeding Lierd E. Grant who is now manager of the Los Angeles branch.

Fairbanks, Morse & Co., Chicago, Ill., announces that R. H. Morse III has been appointed general manager of the Beloit, Wis., works. He succeeds Orren S. Leslie who has been named manager of manufacturing in the Chicago office.

Chain Belt Co., Milwaukee, Wis., announces that the National Safety Council has presented an award of merit to the 300 employes of Plant No. 3 in the construction machinery division for performance of 1,297,204 man-hours of work, from May 29, 1950, to December 31, 1951, without a disabling injury.

Bucyrus-Erie Co., South Milwaukee, Wis., has appointed the Richardson Tractor Co., Charleston, W. Va., as distributor in the state of West Virginia, except the panhandle counties of Hancock, Brooke, Ohio and Marshall, plus the three most westerly counties of Maryland—Garrett, Allegany and Washington.

The Goodyear Tire & Rubber Co., Akron, Ohio, has announced the appointment of J. L. Reid, formerly field representative, as district manager of mechanical goods sales at Salt Lake City, Utah, replacing W. T. Roberts, who has retired after 32 years of service with the firm.

Chase Bag Co., Chicago, Ill., received a 100-year certificate at a Century of Commerce luncheon held recently in New York City, in recognition of its 100 years of business in that city. F. H. Ludington, president, was presented a Certificate of Business Merit by the Honorable Vincent R. Impellitteri, mayor of New York City.

The Timken Roller Bearing Co., Canton, Ohio, announces the death of R. C. Brower, secretary-treasurer and director. He was 60 years of age and had been associated with the company since 1923.

Gar Wood Industries, Inc., Wayne, Mich., has appointed C. J. Berini as division manager of the Wayne division, and H. D. Chicoine as assistant division manager.

Westinghouse Electric Corp., Pittsburgh, Penn., has announced the appointment of Kenneth L. Horgan as eastern district manager of the industrial division. He succeeds J. S.

UNIVERSITY OF MICHIGAN LIBRARIES

Parry, Jr., who was recently transferred to East Pittsburgh, Penn., as assistant manager of the apparatus division.

The **Loomis Machine Co.**, Tiffin, Ohio, has been acquired by a new group which will now be known as Loomis Machine Co. Stuart M. Weaver, formerly executive vice-president of Ideal Electric Co., Mansfield, Ohio, is president of the new company; Clarence A. Riggs is vice-president; W. C. Howe is treasurer; and M. H. Pryor is secretary.

Macwhyte Co., Kenosha, Wis., announces that George C. Wilder has been elected president of the company and appointed a director to fill the unexpired term of the late Jessel S. Whyte. Mr. Wilder, who was vice-president and assistant general manager, has been associated with the company since 1938.

Caterpillar Tractor Co., Peoria, Ill., has appointed Gale E. Allen as supervisor of Trackson products promotion.

Worthington Corp., Harrison, N.J., has appointed the Union Industrial Corp., Carlsbad, N.M., as distributor in Charles, Lea and Eddy counties in New Mexico.

Davey Compressor Co., Kent, Ohio, has organized Davey International, Inc., to handle export sales of Davey air compressors and truck equipment in Central and South America, Mexico and the West Indies, with F. C. Kieser as sales manager.

Baughman Mfg. Co., Jerseyville, Ill., has announced the appointment of Kenneth C. Korte as advertising manager.

Easton Car & Construction Co., Easton, Penn., announces the death of Martin G. Basch, chief engineer, at the age of 71. He had been associated with the company since 1916 and retired in July of this year.

Worthington Corp., Harrison, N.J., has announced the appointment of F. E. Poltier as engineering and service manager for the central region, which includes Detroit, Cleveland, Cincinnati, Buffalo and Pittsburgh. He will make his headquarters in Cleveland.

The Heil Co., Milwaukee, Wis., has announced the opening of a new district office in Cleveland, Ohio, and another in Denver, Colo., also the appointment of the following district managers: Robert Rose at Hillside, N.J.; Fred Wrede at Washington, D.C.; William Schumacher at Cleveland; Herbert Erdman at Milwaukee, Wis.; John Zimmermann at Denver; and D. J. Kuhlman at Chicago, Ill.

Joseph T. Ryerson & Son, Inc., Chicago, Ill., announces the appointment of John W. Queen as manager of the Cleveland plant. He succeeds William O. Springer who has been transferred to New York for special administrative duties.

The Frank G. Hough Co., Libertyville, Ill., was awarded the Putnam Award for the second time at the recent Chicago convention of the National Industrial Advertisers Association.

You'll jump too—but for joy—when you get the big news from Hudson (manufacturers of multiwall sacks with *assured* delivery)!

HUDSON PULP & PAPER CORPORATION
Dept. 111, 505 Park Avenue, New York 22, N. Y.

EVANSTEEL

***Super Strength* Parts**
are "tops" for resisting
SHOCK • WEAR • ABRASION • BREAKAGE

← EVANSTEEL Heat-Treated Hammers have proved far superior to any other material for pulverizing purposes.

EVANSTEEL Dipper Teeth give extra long service even in digging the toughest material. →

← EVANSTEEL Pug Mill Knives are highly wear resistant, yet not brittle.

EVANSTEEL Wire Rope Sockets have had no recorded service failure in 40 years. →

For high-strength parts . . . for an *extra* margin of safety . . . for weight-saving sections . . . use dependable EVANSTEEL. This chrome-nickel alloy has a tensile strength after annealing that averages up to 60% greater than ordinary carbon steel.

Write for EVANSTEEL Bulletin

CHICAGO STEEL FOUNDRY CO.
Kedzie Ave. & 37th St., Chicago 32, Ill.
Makers of Alloy Steel for Over 40 Years

... **KNOCK-OUT!**

High Material Handling Costs

Specify Super-Service

STANDARD

STEEL ELEVATOR BUCKETS

Continuous Type
(Style No. 2 shown)

Salem Type

Write Today. You will approve our Prices and our Service

STANDARD Steel Buckets "stand up like champions" in resisting abrasion and corrosion.

Rigidly built of top-grade steel. Reinforcing strip may be welded to bucket lip, and hard surface rod added, to insure extra service life.

High-economy STANDARD Buckets are available in all styles, types, sizes and gauges.

We are equipped to furnish new units or recondition present equipment at minimum cost.

STANDARD METAL MFG. CO. Malinta, Ohio

Bucyrus-Erie Co., South Milwaukee, Wis., has appointed the Border Machinery Co., El Paso, Texas, as distributor in the seven southernmost counties of New Mexico, including Grant, Hidalgo, Luna, Dona Ana, Otero, Eddy and Lea and the nine Texas counties west of the Pecos river, including El Paso, Hudspeth, Culberson, Reeves, Pecos, Jeff Davis, Presidio, Brewster and Terrell.

Chase Bag Co., Chicago, Ill., has announced the appointment of R. F. Norcott as sales manager in Milwaukee, Wis. He was formerly a salesman in Buffalo and Chicago.

Syntron Co., Homer City, Penn., has announced the organization of a Canadian subsidiary, Syntron Ltd., and the purchase of a manufacturing plant in Stoney Creek, Ontario, Canada.

Bemis Bro. Bag Co., St. Louis, Mo., announces that H. C. Davis, manager of the paper specialty plant in St. Louis, has been elected president of the Industrial Bag and Cover Association.

H. K. Porter Co., Inc., Pittsburgh, Penn., announces that a new branch warehouse and sales office has been established by Quaker Rubber Corp. in Minneapolis, Minn.

Worthington Corp., Harrison, N.J., has announced the appointment of M. E. Ziegenhagen as advertising and sales promotion manager. He was formerly in charge of advertising and sales promotion for General Electric Co.'s Schenectady plant.

S-A for handling **ROCK PRODUCTS** at **ROCK-BOTTOM COST**

for EXAMPLE....

S-A "ROLLER-TYPE" HOLDBACK

For Conveyor and Elevator Headshafts

Provides positive protection against runaway loads, flooded feed points and injury to personnel. A simple roller-and-wedge mechanism engages as soon as headshaft stops rotating forward. No roll-back, no jolt or shock. Releases automatically the instant power is applied. Write for Bulletin 651.

S-A BELT CONVEYORS

Engineered and built to withstand heavy duty service in moving large volumes of materials at low cost per ton. Available in a wide variety of sizes and arrangements—to meet specific operating conditions. Ask an S-A engineer for full details, or write for Catalog 146.

"NATURAL FREQUENCY" VIBRATING CONVEYOR

Uses power *regenerated* by coil springs to move bulk or packaged material horizontally or up incline to 10°. Cuts power needs and costs. Furnished in 10-ft. lengths, with one drive for several sections. Bulletin 950.

STEPHEN S-A ADAMSON MFG. CO.

7 Ridgeway Avenue, Aurora, Illinois • Los Angeles, Calif., Belleville, Ontario

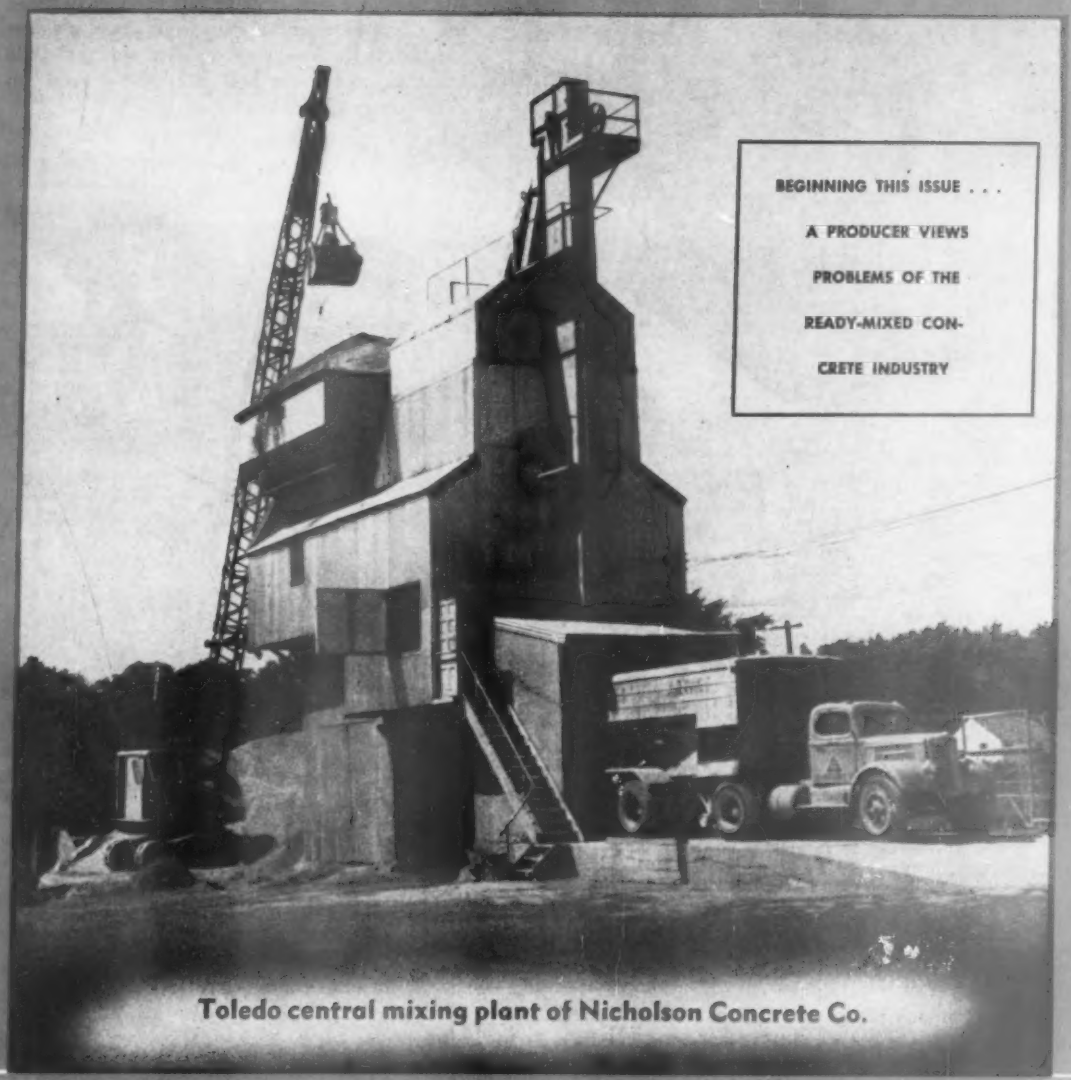
DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

UNIVERSITY OF MICHIGAN LIBRARIES

CONCRETE PRODUCTS

A SECTION OF ROCK PRODUCTS

CONCRETE UNITS · READY-MIXED CONCRETE



BEGINNING THIS ISSUE . . .

A PRODUCER VIEWS PROBLEMS OF THE READY-MIXED CONCRETE INDUSTRY

Toledo central mixing plant of Nicholson Concrete Co.

Fast, clean charging and discharge is just one advantage of the Jaeger "Mix Plus"

No cement blow-back, no spillage of water when you charge this open-end loader: Rubber-faced semi-circular gate completely closes lower half of drum opening while drum revolves for charging. Also prevents any spillage while traveling, no matter how steep the grades you climb on-or-off the road.

Flip of a lever opens gate. Dual levers control high speed discharge of Jaeger's "Dual Mix" drum: It is a demonstrated fact that the Jaeger "Dual Mix" drum, with its wider, correctly shaped continuous spiral mixing blades, plus throw-back blades, is not only fastest to mix but discharges faster and cleaner than any other. Operator controls drum from either front or rear.

3-piece "To-the-Spot" chute meets all conditions: Places concrete where the customer wants it with 5′, 8′ 10′, 13′ chute lengths — or swings clear away for discharging into extra big buckets or high forms.

Jaeger offers these advantages PLUS light weight for biggest legal payloads: "Mix Plus" models mount on any standard make of truck, haul the largest possible legal payload, yet are built for 8 to 10 years' service instead of the 4 or 5 years' life of cheaply constructed units that weigh as much or more and cost as much or more to buy. "Comatic" hydraulically actuated transmission gives finger-tip control. Open or sealed end loaders; water system to suit.

For full information, see your Jaeger distributor or write us

THE JAEGER MACHINE COMPANY

603 Dublin Avenue, Columbus 16, Ohio

World's largest builders of TRUCK MIXERS, AGITATORS • PUMPS • COMPRESSORS • CONCRETE MIXERS • PAVING MACHINES

UNIVERSITY OF MICHIGAN LIBRARIES

INDUSTRY NEWS

Price Regulation Clarified

OFFICE OF PRICE STABILIZATION recently issued Interpretation 1 to Supplementary Regulation 108, which authorized ready-mixed concrete producers to increase their ceiling prices by 4 percent. Since the issuance of SR-108, there has been some confusion as to the scope of the term "ready-mixed concrete." Interpretation 1 clarifies the regulation by authorizing the inclusion of dry batched materials in the term "ready-mixed concrete."

Lith-I-Bar Under New Ownership

ANNOUNCEMENT has been made of a change of ownership in Lith-I-Bar Co., Holland, Mich., producer of concrete joist machinery and concrete block machines. Mrs. Frank E. Milewski, widow of the founder, has sold her controlling interest in the firm to O. W. Lowry and Charles R. Sligh, Jr.

Mr. Lowry, new president of the company, has had wide experience in executive plant management and organization. He is a graduate engineer, holding degrees from Northwestern University and Massachusetts Institute of Technology.

Mr. Sligh, new vice-president and treasurer, is regional vice-president and director of the National Association of Manufacturers.

Concrete Pipe School

AMERICAN CONCRETE PIPE ASSOCIATION will hold its second annual Short Course School of Instruction, November 20-22, at the Sherman Hotel, Chicago, Ill.

One entire day is to be devoted to "Problems in Manufacturing Concrete Pipe," which will be conducted as a round table discussion, led by a selected panel of six or eight manufacturers who will discuss and answer questions arising from problems presented by member producers.

Annual Ready-Mix Short Course to be Held

NATIONAL READY MIXED CONCRETE ASSOCIATION will hold its 7th annual short course for technicians of the ready-mixed concrete and sand and gravel industries at the College of Engineering, University of Maryland, College Park, November 17-21, 1952. The short course is jointly sponsored by N.R.M.C.A. and the National Sand and Gravel Association. The course will in most respects duplicate that held last year, in that it will consist of lectures and demonstrations, with students divided into three groups according to background and interest. The nature of the work to be covered in each group is as follows:

Group 1. Emphasis on laboratory practice with basic instruction in elementary concrete mixture design and calculation of yield.

Group 2. Emphasis on classroom work in concrete mixture design and allied subjects including some advance work with laboratory work restricted to selected demonstrations.

Group 3. Both laboratory and classroom instruction with about equal emphasis on each. This group is considered as intermediate between the two other groups.

New Masonry Association

THE NEW YORK STATE Concrete Masonry Association, with headquarters at 522 Franklin St., Buffalo, N.Y., was recently organized by New York members of the National Concrete Masonry Association. The primary purposes of the new association were stated to be: (1) to maintain close contact with various state departments concerned with the specifications and use of concrete masonry units; (2) to constantly improve quality of product; and (3) to advertise on a cooperative basis. In keeping with their policy of maintaining close cooperation with the National Concrete Masonry Association, members of the new association must also be members of the parent national association.

At a recent meeting held in Syracuse, N.Y., the following officers and directors were elected: Garson Dinaburg, Dinaburg Block Co., Inc., Binghamton, president; Harvey Black, Domine Builders Supply Co., Rochester, vice-president; John Daly, Auburn Cement Products Co., Inc., Auburn, secretary-treasurer; Robert Abbey, executive secretary; and Cyril F. Howe, Albany Block and Supply Co., Inc., Albany. George Kogel, Concrete Corp., New York City; Russell R. Ferrer, Allco Concrete Products Co., New York City; and Grant Reinhold, Anchor Concrete Products, Inc., Buffalo, were named directors.

New Ready-Mix Plant

HERBERTSON SAND AND GRAVEL CO. has established a ready-mixed concrete plant at Englewood, Colo. The plant will serve the Englewood, Littleton, Fort Logan and Westwood areas. Equipment includes five mixer trucks.

Cover Picture

WITH THE SERIES of articles by James A. Nicholson on the subject of ready-mixed concrete beginning in this issue on page 189, we have selected as our cover one of the plants of Nicholson Concrete Co. in Toledo, Ohio. The company has four central mixing plants serving the Toledo area and the delivery fleet consists of 40 truck units.

PINELLAS LUMBER CO., St. Petersburg, Fla., is building a new concrete products plant at a cost of over $275,000. The company will produce precast lintels, shadow brick and block, sun-stone tile, precast window sills, drain tile and precast concrete joists.

SMITHWICK CONCRETE PRODUCTS, Portland, Ore., has announced that lightweight expanded shale will soon be introduced in the Pacific Northwest for making plaster and stucco. The company has completed laboratory experiments and tests to determine the best grading and performance for plaster and mortar.

VERNON CAGLE, Carthage, Mo., recently established a ready-mixed concrete plant at Parsons, Kan. Mr. Cagle also operates plants at Carthage and Pittsburg. James Young has been placed in charge of the Parsons' plant.

FALKVILLE BLOCK & SUPPLY CO., Falkville, Ala., has purchased the plant and equipment formerly owned and operated by Falkville Concrete Products Co. The plant is now producing concrete block and related concrete products. G. D. Sims is plant manager and a partner of the firm.

READY-MIX CONCRETE CO. is a new firm recently established at Chamberlain, S.D. Plant equipment includes a batching plant and two 3-cu. yd. transit truck mixers. Plant officials include Darwin, Harold and Milton Steckelberg, owners of Chamberlain Masonry Products Co., and Kenneth Emme.

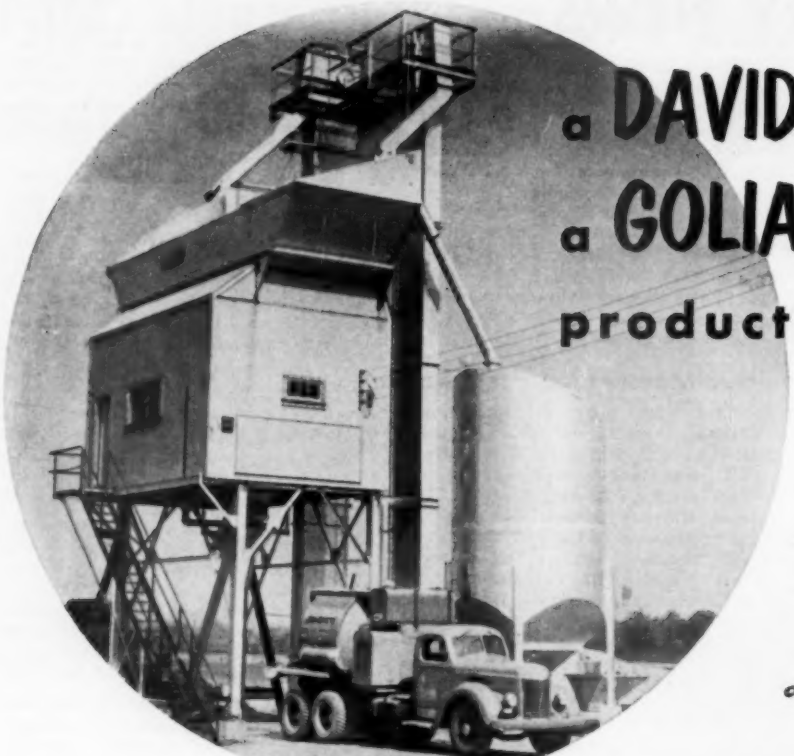
JANESVILLE SAND & GRAVEL CO., Janesville, Wis., which added a concrete block plant to its sand and gravel operation six years ago, recently sold its 10,000,000th concrete block. It is expected that approximately 2,500,000 block will be sold this year, according to company officials. The company serves an area of about 110 mi. radius, including Madison, Wis., which uses approximately 500,000 block per year of the company's production.

PITCOCK BROTHERS, which operates a ready-mixed concrete plant at Graham, Texas, recently established a second plant at Jacksboro, Texas.

GROSSHANS AND PETERSEN, INC., Marysville, Kan., has started the production of ready-mixed concrete. The plant has two 3-cu. yd. mixer trucks in operation and a mobile batching machine for both aggregates and cement. W. F. Kipper is the engineer for the company.

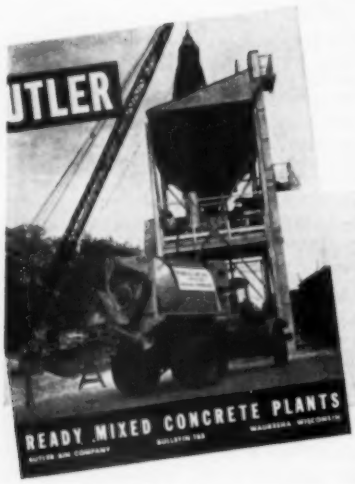
MURRAY ASSOCIATES, LTD., whose main plant is at Richvale, Ont., near Toronto, recently opened a branch plant at Edmonton, Ont., for the production of precast concrete products, including lightweight joists, wall panels and "H-M" distribution floor. A. Main has been named manager of the new plant.

UNIVERSITY OF MICHIGAN LIBRARIES



a DAVID in size . . . a GOLIATH in production . . .

Remarkable portability **is the keynote of this BUTLER Ready Mixed Concrete Plant. The 85 yard 4 compartment bin ships in one piece. Legs and bracing, when knocked down, complete a load for one flat car or low-bed trailer. A second load is made up of elevator, batchers and one-piece overflow cement bin. Erection is quick and easy with a crane and 3 men.**



A number of portable BUTLER Ready Mixed Plants as well as many installations of BUTLER *engineered design* are shown in Butler Bulletin 185. Write for your copy today.

Portability **makes location at your job site practical; eliminates a large investment in costly truck-mixers. And with well co-ordinated delivery of materials either to crane, belt conveyor or elevator — production will be equal to the usual Goliath-like plant.**

For the contractor **meeting tight schedules in any building construction, this plant provides complete control in quality and delivery, to match his requirements. For every pour, large or small, the plant's versatility in production and the low investment required means lower cost per cubic yard and a correspondingly greater profit.**

BUTLER BIN CO.

989 Blackstone Ave.
WAUKESHA, WIS.

1. A producer views the ready-mixed concrete business . . . .

PLANNING FOR PROFITS

By JAMES A. NICHOLSON

IT TAKES a lot of planning and doing to be a truly successful ready-mixed concrete producer. Planning and doing require a knowledge of the basic problems of the business. To be a competent manager of a ready-mixed concrete operation you've got to know the score.

You, as the operating head of a ready-mixed concrete organization, may both own and run the business. You may be managing the business for an owner or stockholders. You may be manager of the ready-mixed division of a large corporation.

Your job is to organize the business so that others get their jobs done properly. You are responsible for the flow of orders and policies to the employes. It's up to you to guide and control the organization in its fight for existence and growth, which can only come from continued profitable operations. When managing for others it is of primary importance that you enjoy sound relations with your superiors. It is your responsibility to keep your superiors (owners or directors) correctly informed on the basic problems of the business.

An alert manager sees a real opportunity in this relationship. He makes certain that notices of company meetings go out on schedule. He follows up the notices with personal calls. At meetings he makes complete and concise reports of operations. He faces facts; he doesn't dodge danger points and shortcomings. He presents on-time accurate reports. He must be certain to get across one message—that he knows what he is doing.

It is your job to acquaint all who are interested in the aims, motives and policies of the company. You should take advantage of every opportunity to sell your organization to directors, stockholders, customers, employes, suppliers, bankers, public officials and the general public. The boss is a company man 24 hr. every day. How he conducts himself in every way is important to these interested people.

This great interest is a challenge to you in your work. Conduct all operations so that they can stand the light of day. Make every effort to avoid exaggerations, misunderstandings, rumors and suspicions. Put reputation beyond price. Establish company policies which require no compromise with your moral principles. Realize that your conduct off the job can reflect against the reputation of the company just as certainly as how you conduct your work. For a successful operation don't take things for granted; take them apart. Carefully plan advances and improvements. Keep asking yourself, "Where and how can we improve?"

In first taking control of an operation it is best to suggest changes that cost little or no money. After these advances have somewhat established you, tackle improvements

Articles to Suggest Sound Operating Practices . . . .

THIS IS THE FIRST *of a series of articles on the subject of ready-mixed concrete that has been scheduled for publication in consecutive issues of* CONCRETE PRODUCTS *extending for well over a year.*

We are pleased to present the series of articles as one of great practical value for the guidance of producers in the solution of their operating problems, and in furthering the industry and the public interest. It is being written by one of the leaders in the industry and is a remarkably intimate and revealing discussion based on personal experience that unquestionably will benefit both small and large established producers as well as newcomers in the industry.

This first article covers the responsibilities and objectives of successful management. The entire series, upon completion, will have given detailed consideration of all phases of a ready-mixed concrete business. Chapters to follow will discuss among other subjects, the planning of a plant, selection of concrete materials, transit mixing, central mixing, fundamentals of efficient plant operation, quality control, concrete mix design and specifications, air-entrained concrete, delivery procedures, customer relations, service, credit sales, employe relations, and promotion and advertising.

James A. Nicholson is president of the Nicholson Concrete Co., Toledo, Ohio. He is a graduate lawyer and first entered the concrete business in 1936 after serving six years as head football coach of Toledo University. Starting from scratch, after taking over a defunct building supply company, he set out to develop a ready-mixed concrete business without previous knowledge. Today, he is recognized as one of the best informed men in the industry. He is vice-president of the Ohio Ready Mixed Concrete Association.

Nicholson Concrete Co. was incorporated in 1950, the business having been operated and built up previously as an individual enterprise. Four central mixing plants serve the Toledo area and the delivery fleet consists of 40 truck units. The company employs 70 men and its volume of sales in ready-mixed concrete is currently at the rate of $1,500,000 annually.

—THE EDITORS

which, while costing money, will surely show savings that will more than offset the additional cost.

Compare performances of the present year with those of past years. Establish performance records to get the best possible response from your men. In golf, players are always trying to beat par. Set up a system of comparative record controls. Determine upon a standard for each set. Then keep trying to beat par.

You determine the policies; you and key men see to it that policies are carried out. Office people, plant men, drivers and mechanics perform the actual operations. You and your key men are responsible for the performance of the other employes. You and the key personnel are the authority to whom the employes look for direction. The smooth functioning of right thinking employes is the mark of real leadership.

Management Fundamentals

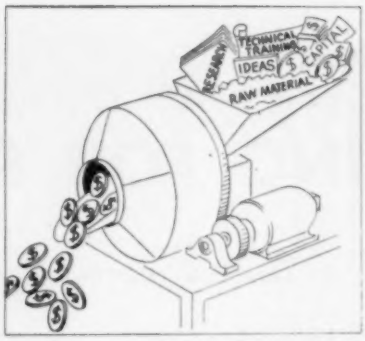
The successful ready-mixed concrete producer carefully lays future plans, and attempts to forecast and budget for anticipated developments.

He programs procedures to meet competition, secure new customers and expand his market. He studies methods of improving the quality of the concrete, increasing production and lowering costs. He sets up proper controls and incentive programs for employes. He keeps abreast of new operations, credit and management techniques. He realistically faces the very important problems of unionism and government regulations.

The successful ready-mixed concrete operator is a specialist in several fields. He knows the fundamentals of the industry. He understands aggregates and their relationship to the processing of quality concrete. He knows how to lay out a plant properly and to operate it efficiently. He is an expert on customer and employe relations. He has a working knowledge of testing and specification procedures. He understands the problems involved in processing and delivering a quality product.

Above all, the successful producer is constantly alert to changes, new developments and future trends. He does not complacently accept things as they are. He is always questioning, experimenting, testing and checking. Ready-mixed concrete is hardly more than an infant. Great advances are before us. Requirements will change. New equipment and techniques will open the door to a bigger, better, more dependable industry.

It is plain that regardless of form or size of an organization, some one has to handle top level duties. In small operations the manager must handle all these jobs. In the bigger organizations key men are picked to



assume responsibilities for the execution of given tasks.

As individual ready-mixed concrete operations grow, rule of thumb methods become costly. Proper operating procedures must be developed. Effective controls are necessary and competent help is required. In all phases of the business somebody must be responsible to see that things are as they should be. In growing operations, key men must be selected to handle top jobs. The time generally comes when employes must be secured and trusted with control duties.

It is fundamental that all key men exercising control functions should be thoroughly grounded in the company's plans, policies and procedures. Top management employes should have a good knowledge of business fundamentals and accounting principles. Principal operating personnel should have either a background of engineering education or practical experience. They should be regular readers of industry trade magazines, association papers and the *A.C.I. Journal*. Member companies should send key operating employes to the short course in concrete instruction sponsored each fall by the National Ready Mixed Concrete Association.

See to it that company policies are being carried out, that morale of the organization is in high gear and that key men are capably handling their assigned tasks.

Make certain that plant superintendents, service men, supervisors and sales representatives clearly understand policies and procedures. If you are too busy to see that policies and procedures are understood and are being followed, put your best man on this job. His work consists in doing the jobs you would be doing if you had the time and had the capacity to be expertly informed on all elements of your business. He should be your "alter ego." His capacities and character should complement your own attributes. On matters in which you might be weak, he should be strong.

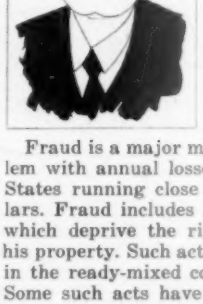
Accounting Procedures

In all businesses, accounting is the first control adopted. The preparation of adequate financial statements provides a necessary basis for filing tax returns and other governmental reports as well as pinpointing information important to management, stockholders, the banker and creditors.

Public accountants are outside experts who examine books of an organization certifying for the benefit of all interested parties their opinions of representations made by management. Certification by public accountants does not release management from responsibility. An audit is simply an additional safeguard—a check upon a firm's accounting.

Primarily C.P.A.'s are concerned with the balance sheet audits, special examinations for financial purposes and preparation of governmental reports. At the year's completion all balance sheet accounts are verified, test checks are made on related profit and loss accounts, and all assets, liabilities, capital and reserves studied and properly set forth.

As ready-mixed concrete operations keep building up in plants, delivery units and personnel, additional control procedures must be devised. Cash, securities, notes, checks and insurance must be brought under careful surveillance. Personnel handling any type of financial transactions must be checked. Proper credit and collection policies must be developed and followed. Forecasts and budgets become necessary. Operation, delivery and maintenance methods must be closely supervised. New developments, new laws and new practices must be understood. All in all, the manager, knowing the size and complexity of his business, must decide what controls and what control personnel will be required to handle his own business efficiently.



Fraud is a major management problem with annual losses in the United States running close to a billion dollars. Fraud includes all criminal acts which deprive the rightful owner of his property. Such acts are widespread in the ready-mixed concrete industry. Some such acts have been discovered in our own operation. Undoubtedly they are, or have been, present in yours. They may be directed against you, your customer or your supplier. They are practiced in the office, at the plant operation and in the delivery.

It is just as important to guard against small losses as against big ones. Most fraud begins in a small way. Alert operators keep such losses small. Opportunity makes the thief. The employe's knowledge that his acts and transactions are being carefully scrutinized is the best possible protection against fraud.

Carefully considered individual records on all main assets should form

UNIVERSITY OF MICHIGAN LIBRARIES

an accurate basis for insurance and tax purposes, for original cost, depreciation and reserve. No sale of obsolete equipment or salvage should be permitted without an accompanying memorandum. Spare parts and accessories (such as tires and tools) should be accounted for by a responsible employe.

Except to avoid the dangers of waste and fraud, our industry faces no great problem over inventory control. Receiving of cement and aggregates should be checked for shortages. If not carefully supervised, batching and mixing operations may develop sizable cement losses. Avoid hand to mouth ordering. See to it that adequate inventories of cement, aggregate and other materials are always on hand to meet anticipated customer demand.

Office men must be checked to see that delivery tickets are properly handled, invoices go out on schedule, credit relations are closely supervised, purchases are made on sound business policy, operation and maintenance costs carefully watched, payrolls properly prepared and required reports are accurately filled out.

In the office, cost figures should get proper attention and follow up action should promptly result. Someone in your organization must understand "costs" and you must use this important information if you are to operate successfully. Check your cost figured against prior periods and, if possible, against outside yardsticks. Use yesterday's figures to give you better profits today and tomorrow.

The ready-mixed operator must provide for proper handling of his accounts receivable. The system must be fast and accurate. Billing should be promptly expedited on a day to day basis. In no way should this work ever be permitted to lag. Personnel must be highly competent. Mistakes made in the company's favor irritate the customer. Mistakes made favoring the customer too often are not called to the company's attention.

There are many failures in business. Like others, our industry has been so plagued. In ready-mixed concrete operations, failures have been generally due to price undercutting, unwise expansion coupled with poor financing, extending credit to too many "fly by night" contractors, and inadequacy of material supply (especially cement.)

If too much of the money from your accounts receivable has to go into monthly payments for plant equipment, trucks and transit mixers, sooner or later you will not be able to pay cement bills promptly, important discounts will be lost and before long you will be in serious trouble. If at the same time you are careless in extending credit and in following up charged sales, collections will run behind charges and you will soon be over the barrel.

The two chief assets of your business should be your customers and your working personnel. In spite of the fact that the main problem of our industry is service, the average ready-mixed concrete operator generally enjoys better relations with customers than he does with his employes. If employe relations aren't what they should be, start now to iron out the bugs.

Today, an employer must be on the ball. Labor contracts, unions, welfare and incentive plans, safety programs, overtime, seniority, government regulations and a host of other problems must be faced. The success of your operation might well depend on how effectively you handle these matters. The future of your company might be ruined by one false step in the labor field. Labor pains are a common problem that all of us must share. In too many cases, the worker's loyalty goes primarily to the union, and secondarily, if at all, to the company for which he works. In the face of such conditions, you've got to make all the working personnel believe they belong to your organization.

Management Tips

Plants must be maintained in good operating condition. Trucks must be kept in proper shape and appearance. If profits are to be controlled, a certain number of man-hours should process and deliver so much concrete. The kind of work you are getting determines your operational and maintenance costs. You've got to know whether or not a man is doing a good job, if he can do it better, or whether he is an asset or liability in the overall picture. Wise use of welfare and incentive plans, safety programs and the suggestion box may actually lead to savings. Such use certainly will improve the quality of your concrete, service to customers and the workers' morale.

In your early days as a concrete man, you undoubtedly had close personal contacts with each and every contractor customer. Today, generally speaking, such close relations are out of the question. Now your contacts with the contractor customer are largely through the order taker, dispatch clerk, service men, the telephone, drivers' performances and exchange of your invoice and his check. As a substitute for personal contacts, service men represent you in the field. Such representatives report service and product failures and help on construction jobs by lining up unloading schedules. Through the field agents you receive complaints against late deliveries, quality of the concrete, drivers' short comings and the lies of the dispatch clerk.

Such contacts are hardly sufficient in these days of unprecedented building volume, lack of hauling equipment, late deliveries and widespread cement shortages. In these days, and indeed at all times, customer relations are highly important. It is vital that you keep your finger on the pulse of things.

Ready-mixed concrete production is a specialized business with success of operations largely dependent on ability to render efficient customer service. The on-time delivery of quality concrete is the main requirement of proper job servicing. A given number of concrete hauling units should handle a certain number of cubic yards per hour. Hourly amounts will vary according to length of hauls, degree of traffic congestion, plant pile-ups and unloading time on the job. The latter is affected by the kind of construction work involved and the comparative efficiency of the customer in placing the concrete. The matter of on-time deliveries is a constant challenge to our industry. To succeed, see this problem through to a real solution.

Customers are lost because the wrong drivers or equipment have been sent to the job, deliveries were late or improperly scheduled, the dispatch clerk repeatedly lied about the time concrete would be delivered, concrete was either too sloppy or too dry, no attention was paid to complaints, the credit manager used poor judgment, certain customers were getting preferred service or prices and invoices were either always late or getting mixed up with those of other contractors.

The right thinking producer has his house in order. He doesn't overlook his equipment. He gets his customers used to ordering in advance. He concentrates his efforts on key customers but doesn't overlook the field. He tries to help customers with their credit problems. He doesn't spread stories about his competitors but is on the look out for contractor customers who have been dumped by other ready-mixed concrete companies on busy days. He reviews his price structure regularly and is always prepared to show the fairness of his pricing system. He avoids sharp selling practices. He doesn't use scare talk. He never misrepresents his product. He stays away from kick-backs and gift offers. He doesn't undercut contractors' prices on direct sales to personal friends. He employs sound sales, advertising and promotion practices. In every conceivable way he runs a decent, efficient operation.

UNIVERSITY OF MICHIGAN LIBRARIES

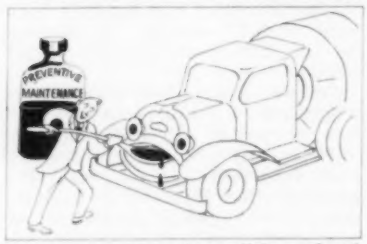
Operations

In the ready-mixed concrete industry, investment is chiefly in plant and delivery equipment. The main part of working personnel labors in the production end of the business. How well you handle processing and delivery generally determines whether you "make or break."

In plant operations the successful producer keeps striving for additional production, closer coordination, fewer breakdowns and tighter controls. He changes existing routines or sets up new methods to effect savings in labor and other costs, eliminate or cut down overtime, lower equipment or material expenses, speed up batching or mixing and improve the quality of his concrete.

He develops plant men so that they can pinch hit on different jobs. He trains them to handle several functions which give his operations the added flexibility needed in case of employe absence or a shifting of the workload. On deliveries, the successful producer keeps striving for lower operational and maintenance costs, more on-time deliveries, and fewer accidents.

The cost-minded producer is on top of his maintenance problems. He regularly practices "preventive" maintenance to avoid down time. By planning ahead and doing required things



on time his operations click on hard busy day schedules. One of the best moves toward more on-time deliveries is the installation of an efficient preventive maintenance program. He buys plant equipment that is rugged and not prone to breakdowns. He sees to it that it is kept in proper operating condition. He orders trucks that are built to handle tough ground conditions and which require a minimum of upkeep. He uses road lug tires that help his trucks over the tough spots. He purchases transit-mixer equipment on the basis of biggest legal payloads, best mixing action, fastest charging and discharging, least end-loader trouble and lowest operating (including maintenance) costs. He makes certain that his trucks and transit mixers are carefully serviced.

In purchasing equipment, the final-service cost is more important than the initial price. Find out as much as you can about the reliability of the equipment that is being considered. Talk with users of such equipment. Ask them about the life of the unit, operating efficiency, breakdown experience and service on repairs and parts.

The thinking producer realistically faces the ups and downs of business. Slow days are handled at minimum operating expense. Through the installation of a down-to-earth delivery program, peak days are taken in stride. Big pours are planned in advance. Key customers are given preferred times of delivery. The plant is opened earlier and closed later to relieve the pressure, the noon hours are used for "emergency must" deliveries and slow orders are scheduled for late afternoon attention.

He realizes that our industry is headed for trouble unless we insist upon putting on the streets properly serviced trucks carrying legal payloads, and sees to it that his delivery units are manned by competent, careful drivers. The certain enforcement of load limit laws presents an important challenge to our industry.

In spite of this challenge many operators are continuing to purchase truck and mixer combinations that cannot possibly handle profitable legal payloads. Operating trucks on the city streets and public roads is a great privilege which should never be abused. Overloading is an act of abuse. The day of overloading trucks is fast coming to an end.

Every sizable ready-mixed organization should have on its payroll a competent concrete engineer to control the quality of its product or else it should regularly use the facilities of a testing laboratory to achieve the same result.

The quality-minded producer uses the soundest, best graded aggregates economically available in his local market. He knows that the quality of his concrete is greatly dependent on the size, gradation and structure of the aggregates in use. He makes certain that the concrete is properly designed so that his product, at lowest cost, has the required strength, workability and durability. Specification writers and testing engineers generally force ready-mixed concrete operators to furnish quality concrete on big work. It is important to our industry that the small user of concrete be similarly furnished with a quality product.

The development of air entrainment is the most significant new factor that has contributed to our industry during the past 20 years. The quality-minded producer understands the importance of air entrainment. He is well grounded in air entraining fundamentals. He sees to it that key employes are thoroughly briefed on proper processing controls so that his plant personnel is able to produce uniform quality air-entrained concrete meeting rigid specifications.

On plant and delivery operations you come face to face with your competitors. The standards of your competitors will form the basis of comparison on service, quality of the product and selling price. Your service basically depends on (1) the spacings, size and efficiency of your plants, (2) adequacy of your trucking facilities, (3) availability of cement and other materials in short supply, and (4) the competency of your drivers, plant operators, order department personnel and dispatch clerks.

You have a vital interest in knowing all facts concerning any interruptions to service. The continuation of good customer relations is dependent on the efficiency of your service efforts. Make certain that all late deliveries, job hold-ups, emergencies, down times and bottlenecks are daily brought promptly to your attention.

The quality of your concrete depends primarily upon the quality of the aggregates and the efficiency of plant controls over slump, strength, yield and air content. See to it that your entire operating personnel is quality minded. Hold all employes to standard weighing, mixing and delivery procedures. Tolerate no carelessness! To be competitive on the selling price you must buy your cement and other materials on a comparatively equal basis. Processing and delivery costs must be under close control and administration expense must be in line.

The completion of a successful year is shown by an annual financial report setting forth details of a profitable operation. Year's end should also be highlighted by a realization that the number of constructive changes developed during the past 12 months gives greater assurances of more profitable years to follow. If year-end figures show that you are enjoying a profitable operation from on-time deliveries of quality, reasonably priced concrete to prompt paying solvent customers, "you have your hand on the throttle."

New Movie Shows Vermiculite Uses

VERMICULITE INSTITUTE, Chicago, Ill., recently released a new, full-colored motion picture, called "Lightweight Champion," showing how a dead load, equivalent to the weight of five elephants, can be eliminated in the average home with the use of vermiculite plaster fireproofing and vermiculite acoustical plastic. The movie explains how the use of these materials gives high acoustical value at low cost, with an official 4-hr. fire rating. Solid 2-in. partitions are also covered.

The film is a 20-min. sound movie and covers small houses as well as multi-story structures. It may be secured for showing upon application to Vermiculite Institute, 208 S. LaSalle St., Chicago, Ill. A speaker, if requested, will also be furnished without charge.

Heating Aggregates in Bins

Suggested method of heating coils would replace present systems where steam is injected directly onto frozen aggregates

By WILLIAM J. SHORE*

THE FOLLOWING describes the principles governing an effective and efficient suggested method for heating bin aggregates. The type of equipment employed is low in cost (decidedly lower than the type of equipment now generally employed), fuel consumption is minimized, and deliveries of heated aggregates may be made rapidly in quantities up to 80 percent bin capacity, all aggregates being delivered in a less moist condition than when originally dumped into bins. This last feature makes it possible to produce a concrete mix of precise proportions conforming to specifications.

Present day methods and techniques for heating have been developed primarily to avoid the delays and inconveniences which occur when aggregates become frozen solid. Since all aggregates employed in the manufacture of concrete must be clean and free from organic matter and other debris, it is customary to wash them before loading into bins. Consequently there is a substantial quantity of water contained in sand and gravel in all bins, which of course will freeze when the temperature drops below 32 deg. F. Until this is thawed out, it becomes impossible to make any deliveries of materials.

By maintaining bin contents at a point above 32 deg. F. at all times, such eventualities are avoided and the smooth even flow of ready-mixed concrete is unimpeded. In recent years, there has been a trend toward the delivery of bin aggregates which have been heated to temperatures substantially above the freezing point. It has been found possible to carry on concrete construction in any degree of cold weather, merely by making use of heated mixtures of ready-mixed concrete. The high temperatures promote prompt and active cement hydration, and the resulting concrete construction proves equal to that produced in warm weather. This capacity to produce concrete structures in any kind of cold weather is of inestimable value to the entire construction industry. It lengthens the number of working days per year, returns more wages to labor, and permits more complete utilization of plant equipment.

There is little doubt that the practice of heating aggregates in cold weather areas of the United States will tend to increase and in time become standard procedure. Payments for this additional service, while not great in actual dollars and cents, nevertheless do constitute a source of greater revenue. This fact alone is of sufficient importance to make producers look more closely into the present manner of heating aggregates, and to study ways for improving these methods for heating sand, stone and gravel in bins.

*Shore Engineering, New York, N.Y.

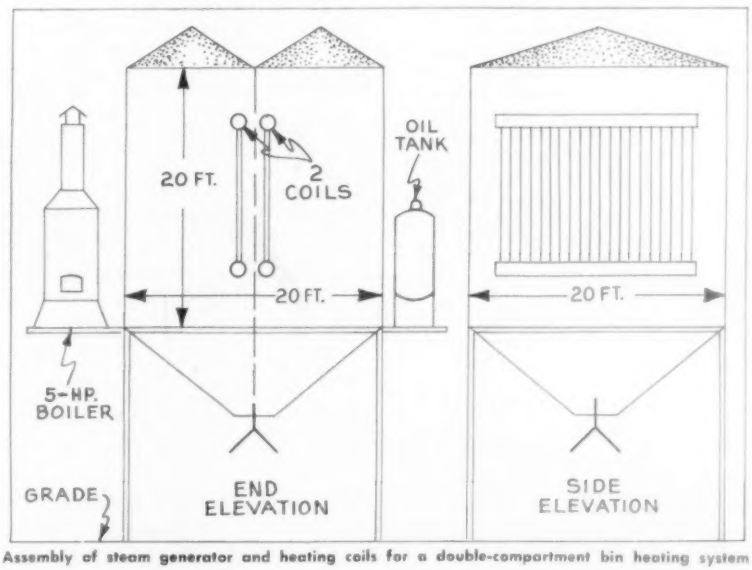
Present Heating Equipment

In practically all bin heating systems, steam is employed, produced in low pressure boilers whose maximum pressure is 15 p.s.i. They may be oil or gas fired, or sometimes coal fired. These boilers average 50 hp. capacity, running in many instances to 100 hp. (A 50-hp. boiler is capable of furnishing 1500 lb. of steam per hr., a 100-hp. boiler 3000 lb. per hr. Note that this has nothing to do with steam pressure; it merely indicates the weight of steam produced per hr.)

In many plants steam is injected into the aggregate mass through a 6-8 ft. length of ¾-in. pipe attached by rubber hose to the steam outlet. The pipe is poked around the mass from the top of the bin to thaw out frozen aggregates. This is inefficient and wasteful. It requires the time of one workman, and it is wasteful of fuel since much steam is lost before it can warm the aggregate.

Among the so-called improvements in bin heating is the system of injecting steam through jets placed in the sides of a hoppered bin. In practice it has been found that six nozzles require the entire capacity of one 100-hp. boiler, and more nozzles than this cannot be employed unless more boiler capacity is installed.

As noted previously, a 50-hp. boiler in a period of one hour throws into the binned aggregates a total of 1500 lb. of water, and a 100-hp. boiler in the same period adds to the bin 3000 lb. of water. The addition of such large quantities of water to the aggregates makes it impossible to determine precisely what the water content of the concrete will be; furthermore, there is no assurance that this quantity of water is evenly distributed through the entire mass of aggregates. Under such conditions, any attempt to deliver a controlled mix in accordance with specifications is usually nothing more than a guess, no matter how accurate the weigh batching scales are. Therefore, regarded simply from the aspect of control of uniform quality of mix, this method of heating bin aggregates adds substantial quantities of water, with no means for registering these additional pounds. The use of live steam on bin aggregates has no place in modern concrete batching techniques.



Assembly of steam generator and heating coils for a double-compartment bin heating system

Physical Limitations Affecting Heat Transfer and Heat Rise

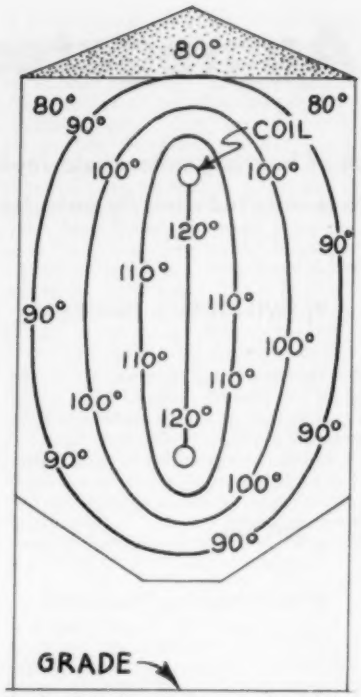
In the attempt to raise the temperature of binned aggregates in 2-3 hr., such as is commonly desired, we come in conflict with the scientific laws that govern the rate of heat transfer from one body to another. In this instance, the thermal energy in the steam is to be transferred to the cold aggregates in the bin. Two factors determine the speed with which these aggregates become heated. One of these is the difference in temperature between the steam and the cold aggregates. Low pressure steam is around 212 deg. F. and cold aggregates might be 32 deg. F. The second factor is the rate of heat transfer through the aggregates.

An easily understood illustration of heat transfer is the common practice of heating cold or wet sand on construction projects by piling it over a corrugated steel pipe and lighting a wood fire in the pipe. Here the temperature of the products of combustion might be 1000 deg. F., and however crude this method may be it is nevertheless very effective. The rate at which heat is transferred varies with the material. Wet aggregates permit heat to pass through more freely than dry aggregates. So, steam heats the aggregates at the point that contact is made, but to heat the interior of a bin takes time because of the resistance of sand, stone and gravel to the flow of heat. This fact, combined with the relatively low steam temperature of only 212 deg. F., makes it an impossible matter to heat completely any batch of aggregates in less than 6 hr. or more.

It is impossible to make complete use of all steam directed into the aggregates, since much of the steam's heat is dissipated into the surrounding atmosphere, and it might be stated with reasonable accuracy that only 25 to 33 percent of the steam applied is used effectively. Because of these factors, the common method of heating aggregates with live steam is wasteful, slow and ineffective and, worst of all, it increases moisture content of aggregates and tends to offset all measures for promoting scientifically controlled concrete mixes. Furthermore, it is known that the central portion of any bin contents leaves first when discharged. The cold core would be discharged while the wet mass adhering to the sides of the bin would come last.

A New Method

The author has developed and worked out a method for heating bin aggregates that overcomes the handicaps and crudities of present day procedure. This method drys out the aggregates and maintains them in the bin in a constant state of dryness, regardless of what surrounding weather conditions might be, or the percent moisture contained in aggregates when originally placed in the bin. In addition to these desirable features, the steam plant required is one tenth or less of the size normally used, and operating costs for fuel are very low. No actual installation has been made to prove these calculations, as yet.



Sketch of isothermal zones in heated bin

Three basic principles distinguish this system from those currently used. They are:

1. Heating medium is high pressure steam, at 125 p.s.i. Whereas the temperature of low pressure steam is 212-220 deg. F., high pressure steam is 340 deg. F., an increase of nearly 60 percent, resulting in a faster heat transfer rate.
2. Steam is passed through specially designed steel coils, designed to fit in the center core of the bin, and also designed for minimum interference with clear discharge of materials from bin. Since the steam at all times is confined to within the tube, no water ever escapes into the aggregates. As a matter of fact, the aggregates begin losing moisture from the time they are loaded into the bin. The longer they remain in the bins, the drier they get.
3. Steam is circulated through the system continuously, 24 hr. per day, 7 days per week.

Steam Supply

Steam is furnished by a small packaged high pressure steam unit, which might easily be mounted alongside the bin on a steel framework of 2-in. angles. The oil tank need only have a 275 gal. capacity, and it too can be mounted next to the bin and out of the way.

A 3- to 5-hp. boiler would be required, delivering from 90 to 150 lb. of high pressure steam per hr. to maintain aggregates at whatever temperature desired.

Example. If it has been necessary to operate one 50-hp. boiler three hr. per day five days per week at full load, then at the end of the week there has been delivered to the bin 50 hp. at three hr. per day, or 150 boiler hp.-hr. per day, or for five days per week a total of 750 boiler hp.-hr. With the suggested system operating 168 hr. per week (24 hr. per day for 7 days), the boiler horsepower required would be arrived at by dividing 750 by 168 hr., or a total of 4.57 boiler hp. That is, this size boiler operating 168 hr. per week would deliver the same horsepower-hr., namely 750. Since this is an odd size, a 5-hp. unit would be chosen. Actually, the bin aggregates would be hotter with continuous operation, since once the temperature has been raised it remains at that point.

Operating the 50-hp. boiler intermittently would not produce the same temperature, since the aggregates would have cooled down in the 21 hr. interval it is off each day making it necessary to restore this heat loss. The only heat required to be furnished by the small unit would be that lost by discharging some of the bin contents, and the heat lost through the walls to the outside.

This principle of supplying energy in small increments over long periods of time to provide for great bursts of energy in short time intervals is familiar to all. A good example is the flywheel, used on engines and crushers. In rotating, the flywheel stores up energy. When a demand comes for greater power than the driving unit normally can deliver, the flywheel returns its stored-up energy to the system and enables the machine cycle to be completed. Similarly, in this method of heating aggregates, thermal energy is supplied in small quantities over long periods

(Continued on page 203)

Table I. Cost of heating aggregates

Temperature rise in deg. F.	Fuel oil at 12 cents/gal. Gal.	Cost	Natural gas at 50 cents/1000 cu. ft. 1000 cu. ft.	Cost
10	20	$ 2.40	2.5	$ 1.25
20	40	4.80	5.0	2.50
30	60	7.20	7.5	3.75
40	80	9.60	10.0	5.00
50	100	12.00	12.50	6.25
60	120	14.40	15.0	7.50
70	140	16.80	17.50	8.75
80	160	19.20	20.0	10.00

UNIVERSITY OF MICHIGAN LIBRARIES

Lightweight aggregate blended with sand and gravel by belt system in Shelby Concrete Products' North Carolina plant

By WALTER B. LENHART

Shelby Concrete Products' new plant

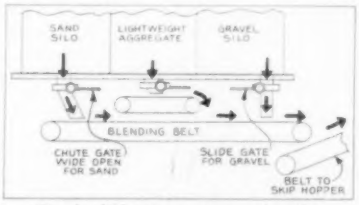
BLENDING AGGREGATES FOR CONCRETE UNITS

NEW CONCRETE MASONRY manufacturing plants built in the Southeastern states during 1951 and to date in 1952 have been practically without exception constructed by men or companies that already were in the business of making masonry units. The only new plant to go into operation in North Carolina in 1952 fits into this pattern. This is the operation of Shelby Concrete Products, Shelby, N.C. It is in a thriving agricultural and industrial town about 45 miles west of Charlotte.

Shelby Concrete Products is owned by Johnson Concrete Co., Inc., Salisbury, N.C., manufacturer of concrete block and concrete pipe, and by Carolina Tuff-Lite Corp., also of Salisbury, manufacturer of the lightweight aggregate "Tuff-Lite." This is made by the sintering process and was described in the August, 1951, issue of ROCK PRODUCTS, page 108. The new organization is also affiliated with important aggregate producing companies in the Southeast.

The growth of the concrete masonry industry in North Carolina has been steady and few states can parallel it. Much of this growth stems from the fact that producers in the area have an active and strong state association. This association is to be expanded this year to include ready-mixed concrete producers in the state.

The new plant is located on a 5½-acre tract near the edge of the city. The Southern railroad and the Atlantic Seaboard railroad serve the plant. It is also adjacent to main highways.



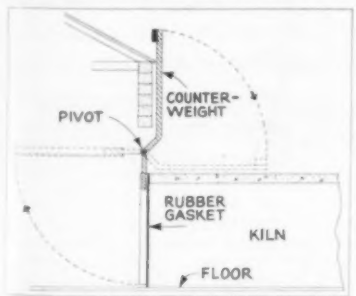
Sketch of blending system under silos

The plant is well laid out; belt conveyors are used to handle all the aggregates. A track hopper, under which is a short 24-in. belt conveyor, feeds to an inclined belt conveyor system which delivers the aggregates to one of three concrete block silos. The curved block for these silos were made in Statesville, N.C. The silos are 35 ft. high and 16 ft. in diameter. Later the silos will be covered. Bulk cement is stored in a 550-cu. yd. steel C. S. Johnson silo.

Reclaiming and blending of sand, lightweight aggregate and gravel is done by a system of conveyor belts in the tunnel under the storage silos

Block are made on a Besser Super Vibrapac and two rubber-tired Erickson fork lift trucks are used to move racks. Four kilns are used and curing is with low pressure steam. Kiln doors are the tilt-up, counter-balanced type, a soft rubber seal insuring a tight fit and a minimum of heat loss.

(Continued on page 205)



Sketch showing operating principle and construction of kiln doors

Exterior view of the four kilns. The arrow points to the counterweight end of the kiln door that is closed, the others are open and the counterweights rest on the kiln roof

SMALL CAPACITY PLANT USES AUTOCLAVE STEAM CURING

Arkhola Sand & Gravel Co. uses two 80-ft. autoclaves to speed up curing of masonry units in one-machine plant

By WALTER B. LENHART

ARKHOLA SAND & GRAVEL CO., Ft. Smith, Ark., is one of the pioneers in the use of high pressure steam curing west of the Mississippi river. The company's success in making a high quality concrete masonry unit has resulted in wide acceptance of concrete block in the Oklahoma-Arkansas area. In a number of instances architectural and designing firms, recognizing the merit of high pressure curing, have specified that concrete masonry units must be cured at elevated temperatures and pressures. Some special credit should be given to the officers of this company who several years ago sensed the advantages of making a masonry unit with low shrinkage characteristics by using high pressure steam curing. The operation also demonstrates that a relatively small company can use this type of curing to advantage.

By the use of high pressure steam curing, a whiter block is manufactured and expansion and contraction due to wetting (or drying), or due to moisture changes in the block are said to be materially lower than with block cured by other methods. Laboratory tests reported by the American Concrete Institute and by private testing laboratories have proved pretty conclusively that shrinkage is reduced in excess of 50 percent by high pressure curing alone, and that a further substantial reduction is effected by application of a vacuum. Higher early strengths in the block are also possible, or conversely, lower cement ratios can be used so as to meet any definite specification.

The plant is well laid out and consists of a Stearns Joltcrete No. 9 and two high pressure autoclaves. One is 8 ft. in diameter and the other 7½ ft. Both are 80 ft. long. The kilns are insulated but some difficulty has been experienced with maintaining exterior insulation because of the severe temperature differentials. The kilns were fabricated at Tulsa, Okla., by the McNamara Boiler and Tank Co., using Jackson and Church bolted ends. The rear ends of the kilns are closed and are of welded construction.

Each kiln has two heavy steel bands (resembling heavy channel iron) equally spaced along the length of the kilns to help carry the high steam pressures used. The bands are welded to the kilns. Steam from a gas-fired Kewanee automatic boiler is delivered to the curing units at 150 p.s.i. pressure and induration continued for 8 hr. An exhauster applies a 26-in. vacuum to the autoclaves, thereby reducing the moisture content practically to that of the surrounding atmosphere. The exhauster is mounted on the roof of the aggregate bins alongside the block plant. The autoclaves have been in service for three years.

The racks used in the kilns are of unique construction. The racks for the 7½-ft. kiln hold 84 block; racks for the 8-ft. kiln hold 132 8- x 8- x 16-in. units. Thus the 17 racks per kiln hold a total of 3672 units. The racks are mounted on four small flanged wheels so that when the lift truck carries a rack into the kiln, final spotting is easily possible.

The doors are bolted into position by means of an impact air wrench. Opening a door requires 15 min. and closing about 20 min. In front of the doors a folding platform of heavy wire mesh is provided for operators to stand on when tightening (or loosening) the upper bolts. When not in use the platform is folded out of the way.

The company has a ready-mixed concrete operation at this yard and two traveling weigh dollies are available, one for the block plant and one

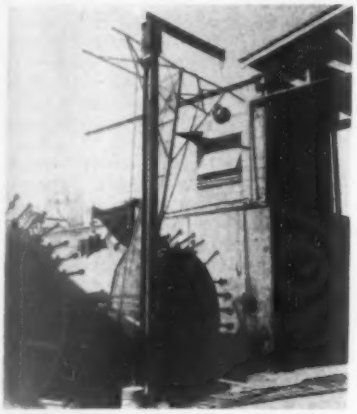
This view shows the pipe hook-up between the autoclaves and the vacuum unit (see arrow); the vacuum pump is mounted on top of the building housing the aggregate bins and the ready-mixed concrete plant, the block plant is at left

The racks for holding block are shaped to fit the autoclave so as to accommodate more units. Top: End view of large racks used in the 8 ft. diameter autoclave; the racks hold 132 block each. Bottom: Side view of the racks. Note the rollers, which make for convenience in moving units in the autoclaves

UNIVERSITY OF MICHIGAN LIBRARIES

for the ready-mixed concrete section. A fleet of six Rex mixer trucks is in service: two 6-cu. yd., two 4-cu. yd., one 3-cu. yd. and one 2½-cu. yd. units. The batcher holds 2 cu. yd.

Aggregates are delivered to the plant by rail from the company's operation at Ft. Gibson, Okla., the plant being a short distance downstream from Ft. Gibson dam (see the May, 1952, issue of ROCK PRODUCTS, page 79).



Arrow points to the wire mesh platform hoisted up out of the way. The platform when lowered permits easy access to the upper bolts on the autoclave doors for tightening and loosening

The company has three lift trucks in service, a 500-lb. Towmotor and a 4000- and 6000-lb. Clark. The latter is equipped with an automatic transmission. The plant located on "O" Street in Ft. Smith has a paved yard.

Besides being in the sand and gravel business, ready-mixed concrete, and concrete masonry production, Arkhola Sand & Gravel Co. is also a producer of asphaltic concrete. Lintels are made at the block plant using a Kent lintel machine; 10- x 30-in. silo staves are also fabricated there on a new Monarch stave machine. Sand and gravel and Featherlite units are made.

Offices of Arkhola Sand & Gravel Co. are in Ft. Smith, Ark. R. N. Dills is president and general manager. W. W. Dills is treasurer and maintains headquarters at Ft. Gibson and Muskogee, Okla., where he also manages the sand and gravel operations at Ft. Gibson. P. M. Shaver is general production superintendent; John Hundley is assistant general superintendent; Blake Berry is sales manager and Miss Winifred Reitz is office manager.

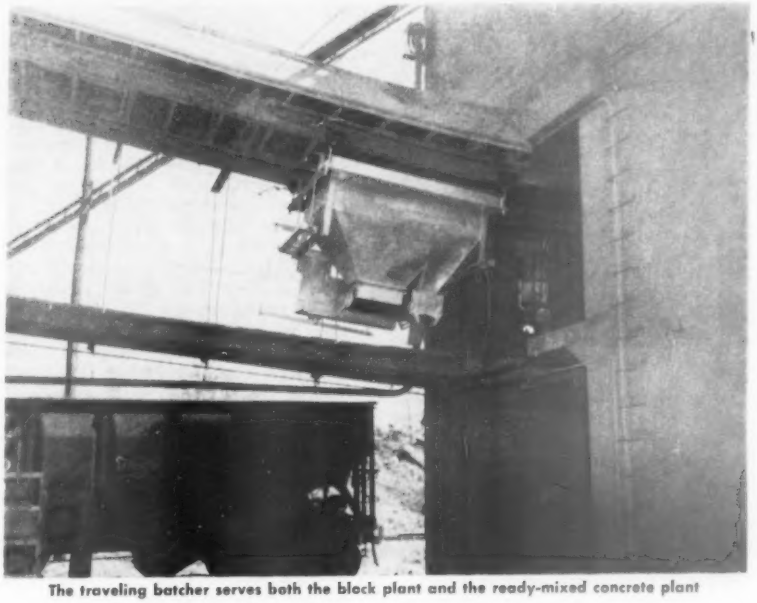
●

Vibrated Concrete

RESULTS OF STUDIES of variation in the compressive strength of vibrated concrete and vibrated mortar cubes were recently reported in *Highway Research Abstracts*. Four series of tests (two concrete and two mortar) were conducted. Within each of the four series, the water-cement ratio was constant but varied from series to series. The effect on compressive strength of varying the grading of the fine aggregate in concrete was observed.

The coefficient of variation of concrete strength was found to be less than 4 percent and that of mortar strength to be more than 5 percent. It was determined that wide variations in fine aggregate grading had no effect on the dispersion of the values of the compressive strength of concrete. The two methods of compaction used for mortar cubes resulted in widely different mean compressive strengths but the coefficients of variation were similar.

Both the 8 and 7½ ft. diameter autoclaves are 80 ft. long. The arrow points to one of the steel bands around the autoclave—an added strength precaution



The traveling batcher serves both the block plant and the ready-mixed concrete plant

Block of Wood Shavings

A NEW BUILDING BLOCK, made of spruce shavings and portland cement, is being promoted by a Canadian producer who has applied for a patent for the process. The wood shavings are treated with a special chemical which, the inventor claims, renders the shavings completely "inorganic" and conducive to a bond with cement particles. The ratio of the mix is 65 percent of treated wood shavings to 35 percent of cement, by weight. The material is molded under pressure for three days and then cured for three to four weeks. Weather conditions and temperature changes are said to cause no variation in dimensions of the block. The block are claimed to provide a pre-insulated, self-supporting wall with no studs or other framing required. In addition, it is said to be fire-resistant and economical.

Cost of the block was said to be about the same as for the equivalent footage of lumber, but savings in erection costs are said to be about 50 percent.

The inventor is building five houses at Prince George, B. C., which will be tested by building inspection authorities and insurance underwriters.

A. C. I. EMPHASIZES PRESTRESSED CONCRETE

Chicago regional meeting devotes major share of program to U.S. progress in prestressing; precast concrete and thin shell structures also discussed

DRAWING ONE of the largest crowds at the Centennial of Engineering Convocation of Engineers in Chicago, the American Concrete Institute's fifth regional meeting, September 10-12, 1952, devoted particular attention to prestressed concrete. The meeting, held jointly with the Structural Division of the American Society of Civil Engineers at the Conrad Hilton hotel, also featured papers on concrete thin shell structures and precast concrete.

It was estimated that about 900 attended the session on prestressing, and about 500 heard the program on thin shell and precast construction. The first day of the meeting was left open for Centennial functions; the technical program filled the next two days.

A. T. Goldbeck, engineering director of National Crushed Stone Association and president of A.C.I., opened the Thursday morning session with a moment of silence in memory of Harvey Whipple, editorial consultant and retired secretary-treasurer of A.C.I., who died September 6. Mr. Whipple had been associated with the institute since 1919, and fulltime secretary-treasurer since 1921 until his retirement in 1952.

It was also announced that William A. Maples had been named acting secretary-treasurer of the institute to succeed Fred F. Van Atta. Mr. Van Atta, who was appointed to that position in early 1952, resigned to become manager of the Building Contractors Division of the Carolinas Branch of the Associated General Contractors of America. Mr. Maples was formerly managing editor of the *Journal of the American Concrete Institute* and has been with the organization since 1948. A. E. Cummings, director of research, Raymond Concrete Pile Co., New York, N.Y., was chairman for the program on Thursday.

The program on prestressing was probably the most complete one since the First U.S. Conference on Prestressed Concrete held at the Massachusetts Institute of Technology a year ago. It included ten papers on the subject, covering uses of prestressing in piers, bridges, machine foundations and buildings, as well as research topics.

Progress in Prestressing

The session opened appropriately with "A Progress Report on Prestressed Concrete," by Myle J. Holley, Jr., associate professor of structural engineering at M.I.T. He reviewed the work that has been done with prestressed concrete, particularly in this country, since the M.I.T. conference. Although Europe continues to lead in the use of prestressing techniques by a substantial margin, the speaker pointed out that progress is evident in this country.

At this date there are about 100 known projects in the United States incorporating linear prestressed concrete construction, either completed or in construction. This, of course, does not include circular prestressed concrete, including primarily pipe and tank structures, which is already firmly established here.

Professor Holley emphasized that additional evidence of the growth of interest was indicated by the increasing number of plants in which prestressed concrete is being produced or research is underway in preparation of such production. According to latest information, there are at least 34 such plants. A few are temporary plants established for specific jobs, but many are directed toward long-range production.

In discussing the variety of prestressing techniques, both post-tensioned and pre-tensioned, Professor Holley said that the high-strength bars used in the Lee-McCall system are soon to be produced in the United States by Stressteel Corp. The system was developed in England.

While foreign developed systems have been widely used, there has also been widespread application of methods developed in this country. Among these are the "headed-wire" reinforcement developed by Prestressed Concrete Corp. and the development of factory strand reinforcement which comes to the job in exact length and with end fittings attached, pioneered by John A. Roebling's Sons Co.

The speaker noted that pre-tensioned reinforcement has been popular for short span, shop-fabricated units. In contrast to European practice, where individual small diameter wires are used, high strength strands, $\frac{1}{4}$ in. dia. or less, have received much attention.

He then mentioned briefly some of the various prestressed concrete bridge jobs. They have been of several types. For spans up to 50 ft., pre-tensioned precast slabs have seen considerable use. As produced by Concrete Products Co. of America, these slabs are of rectangular cross section. Paper tubes are cast in the slab to reduce their dead weight.

Machine made concrete block have been assembled and post-tensioned with strand reinforcement to form a beam. In the system developed by Bryan and Dozier, the block have a modified box section with upper flange narrower than lower flange. In the Anjoh system the block are of I-section.

Post-tensioned beams have been cast in place in some instances; others have been precast and then moved into final position. Professor Holley noted that while beams often have been precast on the bridge site, they likewise have been manufactured in central plants and transported to the job. The latter method has proved practical for beam lengths as great as 65 ft. when a plant equipped to produce the beams economically has been available. Post-tensioned, monolithic beams have been of various cross sections, but the I- and T-shapes have predominated.

There has also been much variety in the use of prestressed concrete applications in buildings, he said; both European and American methods have been employed successfully. He pointed out that many of the applications have provided long spans—spans which could be provided by steel girders, but which would be beyond the usual range of ordinary reinforced concrete. Prestressing techniques have also been used in the construction of roof slabs.

The question of design specifications for prestressed concrete received attention from the speaker, who reviewed the pro and con of the problem. The A.C.I. committee working on this problem has been expanded into a joint A.C.I.-A.S.C.E. committee, which has assembled a proposed nomenclature and is working toward a proposed specification for the design of prestressed concrete.

UNIVERSITY OF MICHIGAN LIBRARIES

Professor Holley closed by saying, "While American achievements in linear prestressed concrete still lag behind the accomplishments in other lands, the events of the past year justify a belief that the gap may be closed in a relatively few years. Certainly these events comprise a big step toward establishing the position of prestressed concrete as an important, competitive structural material."

Shop Manufactured Beams

Another paper of considerable interest to our readers, "Design, Construction and Testing of the Endicott Street Bridge in Danvers, Mass.," was presented by J. C. Rundlett, bridge engineer, Massachusetts Department of Public Works, Boston.

The 28-ft. span bridge used 47 post-tensioned precast beams, each weighing 3200 lb. The beams had a modified T-section. Two longitudinal deformed bars were placed in the top and bottom of each beam; the main stressing units were composed of three 0.6 in. dia. galvanized strands, two straight and one parabolic. Specifications called for 5000-lb. air-entrained concrete with a maximum slump of 3 in.

New England Concrete Pipe Co., low bidder on the contract, chose to fabricate the beams at its Providence, R.I., plant, about 65 miles from the bridge site. The company decided to use a form unit which would enable it to manufacture two beams at one time. The beams were steam cured.

The schedule called for two beams every Monday, Wednesday and Friday. In the morning of the scheduled days a crew of about five men would remove side forms and jack the beam about 3 in. sideways so that when stressed it would not bind in the forms. This took about 30 min.; stressing consumed about 30 min., and it took about 10 min. to remove and stack the beam. Resetting the forms and installation of reinforcement and strands took about 2 hr., and the placing and vibrating of concrete another 1½ hr. After the work was well organized, and barring delays, the entire operation was completed by noon. The crew then went back to their regular work of making pipe for the next day and a half.

A one-bag mixer was set up on the upper floor beside the beam, the concrete chuted to a buggy and then shoveled into the forms. There was only ¾ cu. yd. of concrete in each beam. An internal vibrator was used. Two 30-ton Simplex jacks were used for prestressing the strands.

The strands were stressed twice initially with a load of 13 tons each, being stressed, released, and then restressed. After all beams had been stressed and had time to set, they were restressed to 13 tons before leaving the plant to compensate for loss in stress in the strands. The units were transported to the bridge site by trucks.

Mr. Rundlett reported the various

Heltzel BUILDS IT BETTER

HELTZEL HELPS
CONSTRUCTION DOLLARS
GO FURTHER

NASSAU DOCKS, INC.
REORDERS HELTZEL BINS
Often empties over
3 bins per hour

PROBLEM: To have overhead storage of 1½", ¾", ⅜" stone and run-of-crusher limestone screenings which are delivered in barges; to fill and empty the bins quickly into trucks having 14 to 16-yard capacity; to deliver aggregates in proper proportion from the same bins to an asphalt plant on a conveyor belt. These were the Nassau Docks, Inc., problems.

SOLUTION: Nassau Docks, Inc., ordered four 18-foot diameter, 150-ton capacity Heltzel bins, and at a later date, six more. A two and one-half yard clam-shell loads the bins. For discharging, double-acting clam-shell gates (16" x 16") operate from the ground level. During busy days at Nassau Docks, three or more bins are emptied per hour. The superintendent says that any one of 4 aggregates, or any combination of them, can be moved on the conveyor belt to the asphalt plant.

● Nassau Docks, Inc., furnishes aggregates for its own asphalt plant, for contractors and Hendrickson Brothers, with whom Nassau Docks is allied. Specialized Heltzel engineering features circular and square bins; 50-degree sloping sides of cone; a choice of clam-shell, single arc or roller gates ranging in size from 12" x 12" to 30" x 30" which are air or manually operated.

Ease of assembly is testified to by steel erectors time after time. Heltzel has solved hundreds of similar problems effectively; so why don't you write regarding your storage, loading, mixing, unloading, batching or materials handling problems?

Heltzel BUILDS IT BETTER
The Heltzel Steel Form & Iron Company
Construction Equipment Since 1910
WARREN, OHIO
Flex-Plane

problems encountered during the manufacture of the beams and the various tests made. He said that the Department of Public Works is planning further use of prestressing in bridge structures.

Research A Must

N. M. Newmark, research professor of structural engineering, University of Illinois, Urbana, in his paper "What Do We Need to Know About Prestressed Reinforced Concrete?" emphasized the major points of uncertainty in the present knowledge of prestressed concrete. The most important aspect of the problem, he said, is concerned with the basic philosophy of design. This involves the selection of factors of safety or load factors, and must be solved before a consistent design procedure or code can be formulated. He then explained the role that research plays in the solution of the problem.

He discussed fundamental concepts involved in design such as working loads, useful strength, ultimate strength, brittle and ductile failures, and factor of safety, and then made some comparisons between prestressed and ordinary reinforced concrete.

Besides the major problem of the selection of the proper basis for design, Professor Newmark noted some of the specific problems which must be solved to permit the most efficient and economical use of prestressed concrete. These included bond, anchorage and prestressing methods; fatigue strength; fire resistance; sustained loading; reversed loading; blast loading; and continuity.

"Results of Some Bond Tests on Prestressed Concrete," by Jack R. Janney, associate development engineer, Portland Cement Association, Chicago, Ill., described briefly some of the work being done by P.C.A. at its Skokie, Ill., laboratory. The variables being considered in the bond studies were:

(1) Bonded versus unbonded prestressing elements.

(2) Influence of wire diameter on bond.

(3) Twisted strands and single wires.

(4) Effect of surface characteristics of wire.

(5) Anchorage length.

(6) Concrete strength.

Other papers presented during the day-long session on prestressing included "Prestressed Elements of New York Harbor Pier 57," by E. H. Praeger, chief engineer, Madigan-Hyland, Long Island City, N.Y., where 2954 pre-stressed and 194 post-stressed precast concrete members were used. Robert Shama, consulting engineer, Freyssinet Co., Inc., New York City, described design and construction of "The Largest Concrete Spans of the Americas: Three Prestressed Concrete Bridges on the New Caracas-La Guaira Highway." The paper prepared by A. M. Klein, assistant manager, New York District, Robert W. Hunt Co., New York City, and J. H. A. Crockett, civil and structural engineer, London, England, presented a new use for prestressing in the design and construction of a fully vibration-controlled forging hammer foundation.

"Prestressed Concrete in Tampa Bay Bridge," by W. E. Dean, engineer of bridges, Florida State Road Department, Tallahassee, and "Prestressed Concrete Girders—Manhattanville College," by Curzon Dobell, president, Preload Enterprises, Inc., New York City, covered other aspects of prestressed concrete. Rear Admiral J. F. Jelley, chief, Bureau of Yards and Docks, Department of the Navy, Washington, D.C., as final speaker on Thursday, summarized the session.

Precast Concrete

The Friday program was concerned mainly with precast concrete and thin shell structures; Stewart Mitchell, principal bridge engineer, California Division of Highways, Sacramento, was chairman.

"Precasting of reinforced concrete highway bridges has developed in some areas of the United States to a point where it has been demonstrated quite conclusively that the method has definite advantages in many instances over the conventional cast-in-place construction and structural steel," stated Eric L. Erickson, chief, Bridge Branch, Bureau of Public Roads, Washington, D.C.

He described various systems of precast concrete used in highway bridge construction. It has been used to advantage particularly in short span structures.

Mr. Erickson called attention to the need for standardization so that bridge members of precast concrete can be manufactured in plants on a commercial basis to obtain maximum economy. Factory operation permits close control of the concrete mixture, placing and curing, to obtain better and more durable construction, he said.

He mentioned the various places where precasting has been used. These included precast piles, beams and girders, floor sections, cribbing and pipe culverts. Pipe culverts have offered probably the widest use of the precasting method in the highway construction field, he said.

Louis P. Corbetta, Corbetta Construction Co., New York City, presented slides and discussed the topic "Precast Concrete Offers New Possibilities for Design of Shell Structures," a paper prepared by Pier Luigi Nervi, consulting engineer, Rome, Italy. "Precast Concrete Foundations in New York Harbor Pier 57" was the topic of E. H. Praeger.

The papers on thin-shell concrete design and construction included "Reinforced Concrete Shell Construction," by Charles S. Whitney, of Ammann and Whitney, consulting engineers; "Analysis and Tests of a Cylindrical Shell Roof Model," by Bruno Thurlimann, Lehigh University, Bethlehem, Penn., and Bruce G. Johnston, University of Michigan, Ann Arbor. Anton Tedesko, Roberts and Schaefer Co., Chicago, Ill., presented "Construction Aspects of Thin Shell Structures." "Fire Resistance of Reinforced Concrete Floors," by J. P. Thompson, Portland Cement Association, Chicago, Ill., concluded the session.

The technical program committee for the regional meeting was under the chairmanship of C. E. Wuerpel, technical director, Marquette Cement Manufacturing Co., Chicago, Ill. Committee members included L. H. Corning, Portland Cement Association, Chicago; A. E. Cummings and Myle J. Holley, Jr. H. C. Delzell, managing director, Concrete Reinforcing Steel Institute, Chicago, was chairman of the general arrangement committee.

Technical Problems Committee Meeting

THE MID-YEAR MEETING of the Technical Problems, National Concrete Masonry Association, held in San Francisco, Calif., featured progress reviews on several research projects being conducted by members of the committee in cooperation with R. E. Copeland, director of engineering for N.C.M.A.

The program included a joint report by Benjamin Wilk, Standard Building Products Co., Detroit, Mich., and George Mansfield, William Moors Concrete Products Co., Fraser, Mich., on "Effect of Curing Conditions on Strength of Concrete Block." Mr. Wilk also gave a report on "Effect of Mixing Time on Certain Properties of Concrete Block Mixes."

Mr. Copeland summarized the results to date of several association research projects now underway, including tests of the sound transmission of plain and painted concrete masonry partitions, and tests of reinforced concrete masonry structural members such as lintels and cantilever type retaining walls.

Other reports included: "The Merits and Problems of Using Fly Ash as Partial Replacement of Portland Cement," by Edmund H. Brooke, National Brick and Supply Co., Inc., Washington, D.C.; "Suggested Design of Kilns," by Geno Camosse, Camosse Brothers, Inc., Auburn, Mass., and Alfred Paolella, Plasticrete Corp., Hamden, Conn.; "Protective Coatings for Steel Racks," by Paul Bronson, Best Block Co., Milwaukee, Wis.; "Comparative Merits of Normal and High Early Strength Portland Cements," by T. L. Goudvis, Concrete Masonry Corp., Elyria, Ohio; "High Pressure Steam Curing as Applied to Expanded Slag Block," by P. M. Woodworth, Waylite Co., Chicago, Ill.

●

A NEW READY-MIXED concrete plant has been established at Greenfield, Iowa, by Bill Haines. Plant equipment includes a 3-cu. yd. truck mixer.

UNIVERSITY OF MICHIGAN LIBRARIES

DOLLAR FOR DOLLAR

...YOU CAN'T BEAT CHALLENGE

MORE CUBIC FEET OF DRUM SPACE FOR YOUR INVESTMENT
EARN ADDITIONAL PROFIT ON EVERY TRIP!

When selecting your next truck mixer, add all the advantages of Challenge Mixers together . . . lower initial cost . . . lower maintenance cost . . . lightweight . . . immediate availability of standard automotive repair and replacement parts . . . PLUS the advantage that four of Challenge's *six* sizes have greater "rated" drum volume. You'll come up with only ONE answer . . . *Challenge is by far your greatest mixer buy!*

Clip the coupon below for the name and address of your nearest Challenge Dealer.

"COMPARE THE COST PER CUBIC FOOT OF DRUM SPACE OF CHALLENGE WITH ANY COMPETITIVE MIXER".

CHALLENGE MIXERS		COMPETITIVE MIXERS		EXTRA CUBIC FEET DRUM VOLUME IN CHALLENGE
SIZE	CUBIC FEET DRUM VOLUME	SIZE	CUBIC FEET DRUM VOLUME	
3½	174	3	153	21
4	195	3	153	42
5	241	4½	218	23
6	290	5½	263	27

Challenge Mixer Sizes conform to the basic Truck Mixer Manufacturers Bureau standards of total cubic feet of drum space in relation to rated mixer size and concrete payload capacity.

COOK BROS. EQUIPMENT CO.

Exclusive National Distributors For CHALLENGE TRUCK MIXERS...the profit line

1815 No. Broadway, Los Angeles 31, Calif.
Telephone: CApitol 2-9111

Manufacturers of: HEAVY DUTY TRUCKS • TRUCK EQUIPMENT • DUAL CHAIN DRIVES • DUAL GEAR DRIVES • HYDRAULIC HOISTS • DUMP BODIES • TRAILERS • TELESCOPIC DUMP TRAILERS • BOTTOM DUMP TRAILERS • LUMBER TRUCKS • SIX WHEEL ATTACHMENTS FRAME EXTENSIONS

Cook Bros. Equipment Co.
Please send name and address of nearest Challenge dealer.

NAME _____

ADDRESS _____

CITY _____ STATE _____

Member N.R.M.C.A.

NEW MACHINERY

Block machine with manual swinging take-off

Block Machine

THE KENT MACHINE CO., Cuyahoga Falls, Ohio, has developed the Duplex Blockmaker which produces two block, or equivalent, per cycle. Interchangeable mold boxes are available to produce four 4- x 18- x 16-in., three 6- x 8- x 16-in., two 8- x 8- x 16-in., or one 12- x 8- x 16-in. block each cycle.

Three rotary agitation shafts in the feed drawer provide feeding to the mold box and block. The machine is furnished with a manual swinging take-off or a front take-off for use with an air operated offbearing hoist.

Fork Lift Truck

THE BUDA CO., Harvey, Ill., has announced the manufacture of a 6000 lb. capacity fork lift truck. The truck is rated at a 24-in. load center and is available with a choice of two gasoline or two diesel engines.

Model FT60-24 is powered with the manufacturer's 73½-hp., 6-cyl. gasoline engine and is available, as optional equipment, with a 4-cyl., 53½-hp. engine.

Fork lift truck with 6000 lb. capacity

A 6-cyl. diesel engine with a 230-cu. in. displacement is standard for model FTD60-24 with an optional 4-cyl., 182-cu. in. displacement diesel engine.

A 72, 84, 108, 114 or 120 in. lift is available as standard on either the diesel or gasoline powered truck.

New Masonry Paint

MEDUSA PORTLAND CEMENT CO., 1000 Midland Building, Cleveland 15, Ohio, recently announced the development of a new prime coat for porous masonry, called "Medusa Ruf-Seal Cement Paint."

According to the company, this paint was developed primarily for lightweight aggregate concrete block surfaces which have a high and variable degree of porosity and absorption, making a good paint job difficult to obtain with conventional paint. The new prime coat is said to seal thoroughly the pores of the block, preventing absorption and improving appearance and workability of succeeding coats of paint.

New prime coat, designed especially for lightweight concrete block

The manufacturer states the paint is easily mixed by adding water and recommends that it be applied with a scrub brush so the paint may be thoroughly worked into the pores. The paint mix is packaged in 25-lb. containers and is made in one color, white.

Invisible Liquid Waterproofing

DASCO CHEMICAL CO., INC., Baltimore, Md., has put on the market a transparent liquid exterior wall waterproofing compound, called Dashide. The compound can be either brushed or sprayed on, and it penetrates ¼ to ½ in. into the wall surface, depending on porosity. It is said to be resistant to acids, alkalies and temperature extremes without checking, cracking or peeling.

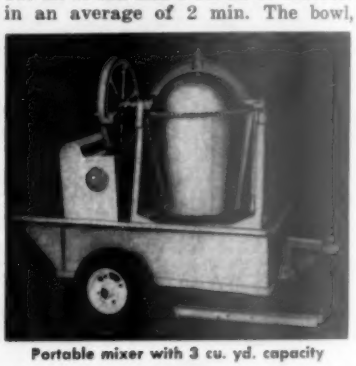
The company also announces a fast-setting floor patch material which contains metallics and pure rubber latex called Das-Patch. The filler can be applied to wet or dry cement, concrete, asphalt, brick or mastic floor. To apply, the hole or fissure is swept clean and the primer is brushed in. After setting for a few minutes, Das-Patch is used as taken from the drum and tamped level after the hole is filled. Five to ten minutes are required for drying. The filler does not contain any cement, gypsum, stone or similar aggregates.

Electric Truck

THE YALE & TOWNE MANUFACTURING CO., Philadelphia 15, Penn., has announced the availability of a 4000 lb. capacity high lift platform truck with an 80-cu. ft. end-dump hopper. The hopper can be tilted downward to scoop up loads or it can be loaded from overhead. The truck is a standard electric high lift platform truck with a specially shortened platform to accommodate the hopper. The platform elevating mechanism is used to dump the hopper.

Portable Concrete Mixer

THE WRIGHT ENGINEERING AND SUPPLY CO., 1304 South Bannock St., Denver 10, Colo., has developed a portable concrete mixer weighing only 147 lb. It can mix 3 cu. ft. of concrete in an average of 2 min. The bowl, pulley wheel, yoke and end bearing castings are formed of solid aluminum alloy; the drum, made of 16 gauge steel, is machine rolled and flanged to the bowl in a continuous rivetless joint and turns on a centered, cold rolled steel shaft. The entire unit is mounted on an electrically welded framework of steel angles with reinforcing gusset plates. Holes punched in the frame accommodate the board on which an optional gas or electric motor may be mounted. Two Torrington roller needle bearings support the drive shaft.



Portable mixer with 3 cu. yd. capacity

Oil Base Masonry Paint

THE SURFACE PROTECTION CO., INC., 16832 Euclid Ave., Cleveland 12, Ohio, has developed an oil base masonry paint called Bloc-Seal which is said to give one-coat coverage. It can be applied both above and below grade, exterior and interior. It is resistant to lime, alkali, salt, mold and fungus, the manufacturer states. It is available in seven pastel colors.

UNIVERSITY OF MICHIGAN LIBRARIES

Heating Aggregates

(Continued from page 194)

to large masses of aggregates. When material drawn out of the bin is replaced with cold aggregate, the steam heating system begins transferring heat into the new mass to make it ready for future deliveries.

Naturally, the storage bin capacity must be proportionate to deliveries in order to allow sufficient time to replenish heat that has been lost through deliveries. Also, the degree of temperature rise must be considered. Low temperatures only sufficient to prevent freezing require minimum capacity, whereas high temperatures sufficient to deliver material at 100 deg. F. in zero weather would obviously demand more bin and coil capacity. Though steam generating equipment of only 10 percent capacity is demanded in this system, the initial cost is not in the same proportion. A 50-hp. steam generator installed complete, ready to operate, may cost from $5000 to $6000. A 5-hp. high pressure steam generator may be installed complete for between $850 and $950, or an initial saving of from $4000 to $5000. However, this saving would be offset somewhat by the cost of the bin heating coil assembly.

Temperatures in Bin

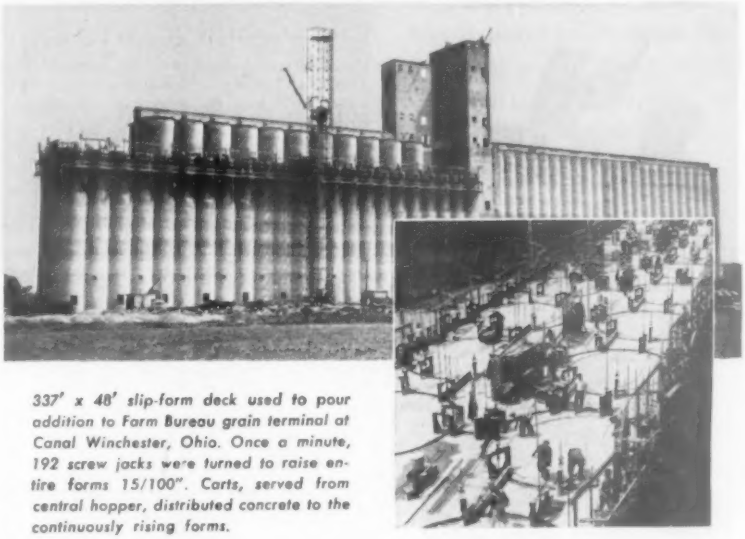
As compared with present methods for heating aggregates, the temperature distribution among bin aggregates, using the suggested system, is definitely planned in advance and follows a specific pattern. If temperature readings were made throughout the bin and isothermal curves plotted, the diagram would resemble a section of an onion, with its core and successive outer layers. This method of heat distribution is ideal. Whatever heat escapes or is transferred from the hot coil to surrounding aggregates must go entirely through the aggregates, and none is wasted except that flowing to the surrounding atmosphere from the outsides of the bin. If this loss appears substantial, it may be retarded by applying layers of low cost insulating board to the bin. Under normal circumstances there is a constant flow of steam through the steam coil. If temperature of bin aggregates rises too high, a simple type of thermostat would shut off the steam generator until the time when temperatures dropped below requirements.

When material is dropped from the bin, its place is taken by aggregates that have been in the top of the bin These are warm, but not as warm as the material that had been there previously. Upon coming in contact with the steam coil the new, colder material begins to take on heat gradually, and by the following day the heated aggregates are ready for delivery as soon as the plant has opened. No time is lost waiting for aggregates to be heated.

It takes years to get rich overnight

High standards of truck mixer design, guaranteed by the Truck Mixer Manufacturers Bureau, have over the years built architect and engineer acceptance for ready mixed concrete. Adherence to those standards protects the investment of every operator whose mixers or agitators bear the Bureau Rating Plate.

(Advertisement below is being read by your best customers in Architectural Record, Engineering News Record, Western Construction and Southwest Builder.)



337′ x 48′ slip-form deck used to pour addition to Farm Bureau grain terminal at Canal Winchester, Ohio. Once a minute, 192 screw jacks were turned to raise entire forms 15/100″. Carts, served from central hopper, distributed concrete to the continuously rising forms.

How to pour a 1,200,000 bushel basket — in one piece

By a continuous pour of 6,000 cu. yds. of ready-mixed concrete, into slip-forms raised on jackrods at the rate of .15″ every minute, this elevator addition was completed in 168½ hours. The 24 bins, each 20′ in diameter and 127′ high, and interstitial walls, covering a 337′ x 48′ area, form one monolithic structure without joint or seam.

Because concrete design envisions a homogeneous material, of numerous elements completely mixed, the ready-mixed concrete industry certifies by Rating Plate those truck mixers and agitators which have the proper design, capacity, drum speed, mixing action and water control necessary to produce a homogeneous concrete of uniform strength.

Look for this Badge of Dependability on Truck Mixers: You have a right to insist on this Rating Plate on any truck mixer that serves your jobs. It is available to all who comply with the quality standards established by the National Ready Mixed Concrete Association and the Truck Mixer Manufacturers Bureau.

These member manufacturers comply with Bureau standards

BLAW-KNOX DIVISION Pittsburgh, Pa.	CONCRETE TRANSPORT MIXER CO. St. Louis, Mo.	THE T. L. SMITH COMPANY Milwaukee, Wis.
CHAIN BELT COMPANY Milwaukee, Wis.	THE JAEGER MACHINE COMPANY Columbus, Ohio	WORTHINGTON PUMP & MACHINERY CORP. Dunellen, N.J.

MOVING CONCRETE MATERIALS from a railroad car or Batch-Hopper?

KEEP THEM FROM STICKING WITH A CLEVELAND Air Vibrator!

The Type LSRR Air Vibrator illustrated herewith steps up unloading time of all concrete materials inclined to pack down, arch or bridge in transit.

The LSRR can be easily moved from one installation to another by just lifting from the female bracket, standard on most covered hopper cars. It's a tough, long lasting, efficient unit.

The CLEVELAND Type F Air Vibrator is light weight, yet a hard hitter. No other method of vibration is so mechanically simple. Slugs the side or skin of a hopper and keeps aggregate, cinders, cement, gravel, sand, and other materials stepping right along.

Available in 6 different piston diameter sizes. If noise is objectionable—air-cushioned quiet type available.

BIN STUCK LATELY?

NOTE: These two Air Vibrators are merely typical of our complete line. We have a type and size to fit practically any bin, hopper, chute, screen, storage tank, etc.

Catalog No. 105 is yours for the asking.

THE CLEVELAND VIBRATOR COMPANY

2712 Clinton Ave. • Cleveland 13, Ohio

It is apparent that none of the steam used for heating ever comes in contact with the aggregates. Thus, at no time is water ever added to the aggregates. Furthermore, due to the heat of the coils and the gradual transfer of heat throughout the mass, water is vaporized, significantly reducing the moisture content. It is most unlikely that moisture in bin aggregates will ever drop to zero percent, but there is no doubt that these aggregates heated in the manner described will definitely have a lowered moisture content and consequently will flow more easily on discharge. With the reduction of much of the guesswork about moisture content, it becomes possible to deliver at all times aggregates properly proportioned by weight.

Temperature and its Control

In a way, this system has an inherent quality of automatic control, for the lower the aggregate temperature the more steam will be condensed in the coils. When temperatures tend to run too high it is simplest to cut down the rate at which fuel is supplied to the burners. Usually the bin capacity and the number of cubic yards sold daily govern the amount of heat to be supplied. Once experience has determined this, adjustment of the fuel supply makes it possible to supply just about the right amount of heat continuously. A simple thermostatic control can shut off all heat in the event that too much steam is being supplied. Minimum automatic controls are to be desired.

Cost of Operation

The cost of fuel for this type of bin aggregate heating would probably be minor. Total annual fuel consumption is based upon two factors, (1) the number of cubic yards of heated aggregates delivered per year, and (2) the temperatures to which these have been raised.

As a means for estimating fuel requirements, either natural gas or light fuel oil, Table I furnishes reasonably accurate information. A set of costs has been worked out for oil at 12 cents per gal., and for natural gas at 50 cents per 1000 cu. ft. of 1100 B.t.u. per cu. ft. gas.

By temperature rise is meant the number of deg. F. it is desired to raise the temperature of stored aggregates above ambient temperature. If outside temperatures are 0 deg. F., a 40 deg. rise is essential to bring aggregates above freezing. If outside temperatures are 30 deg. a temperature rise of 5 deg. F. might be sufficient. Cost of raising the temperature is the same per degree rise regardless of what range is employed. Quantities of oil and natural gas are approximate, but are sufficiently accurate to provide this cost information. The data can be adjusted for local price of fuel, as well.

Summary

Present day means for heating bin aggregates are crude, costly and inefficient. They involve costly equipment, low fuel economies, and they fail in their purpose of heating bin aggregates quickly and effectively. Their worst feature is the condition in which aggregates are left subsequent to heating. With unknown quantities of water added, it is difficult to batch concrete mixes with much assurance of exact proportions.

The suggested method, as described in this article, may or may not be the final improvement that is possible as a means of heating aggregates. Its merits are worth due consideration. A heating plant is required that is only 1/10 the capacity of those now in use. Lower installation costs would result. It keeps constant or reduces the moisture content of aggregates. Because heat is applied to the core of the aggregate mass, there is little loss of heat to the outside. Fuel requirements are very low. Since the storage bin is heated 24 hr. per day, the entire mass will eventually reach a preset temperature level. It is therefore possible, if ever so desired, to load the entire bin contents into trucks at one time, as quickly as they can be loaded and moved out. It is this feature of complete delivery of entire bin contents at a constant temperature that makes this system a valuable aid to meeting unusual demands for heated aggregates.

BAUGHMAN

HI-SPEED JOB-FITTED Portable and Stationary CONVEYORS

Years ahead in design and construction.

Built better to last longer!

PROMPT DELIVERY.

Write for Catalog A-339.

BAUGHMAN MFG. CO., INC.

1111 Shipman Rd. Jerseyville, Illinois

Move MORE materials at LESS cost!

Model 230

UNIVERSITY OF MICHIGAN LIBRARIES

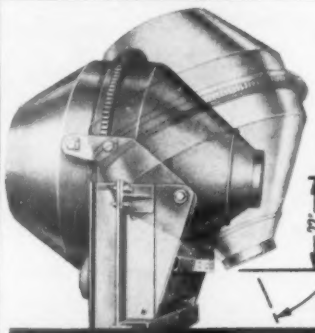
Blending Aggregates

(Continued from page 195)

That portion of the yard now used for storing block is paved. The company has three Studebaker trucks and a trailer-tractor for delivery purposes.

One unusual feature of the new operation is the method used to reclaim and at the same time to blend the three types of aggregate used. Tuff-Lite block are featured at this plant, but sand and gravel block are also made, and if desired, units made of all three materials can be manufactured. The blending system makes use of conveyor belts operating in a tunnel under the silos. The Tuff-Lite is fed to the blending belt by a short belt feeder. The sand and gravel is fed to the same belt through chutes with horizontal slide gates for control. Continental Gin Co. idlers are used on the conveyors in the plant. The belt delivers to a pocket where the portland cement is weigh batched by Johnson equipment. A skip from the Besser mixer serves the block machine. The drawing gives the essentials of the blending system.

Officers of Shelby Concrete Products are as follows: A. Starling Johnson, president; A. S. Johnson, Jr., vice-president and secretary; George Corn, vice-president and treasurer; Dick Estes, plant manager, and Miss Sadie Lutz, office manager.



TILT-UP

CLEAN UP with

FOR CONVERTING TO CENTRAL MIX

As it requires less headroom, the TILT-UP SuPREMIXER is the only mixer feasible in most plants. It's easy to install; no raising of the plant or lowering of drive.

FOR A PACKAGE PLANT

Reduced headroom requirement means reduced height, construction and power costs. Efficiently permits dry batch in one lane, central mix in the other.

FOR A SEMI-PORTABLE PLANT

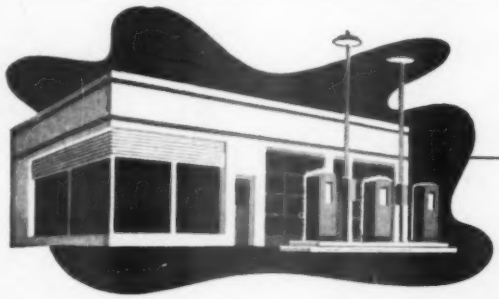
Crane feeding is easy with SuPREMIX. Separate A-frame mounting with bin structures bolted for quick, easy set-up provide real flexibility for your rush defense jobs.

Only the SuPREMIX TILT-UP, 3-3½ yard hydraulically controlled mixer can give you *all* these advantages: lower headroom requirements—steeper discharge of 65°—no segregation—reduced thrust—and virtually fixed discharge. The hydraulic system is part of the unit—no costly compressor to buy. The unique features of this mixer make it the ideal mixer...

Aggregate Bins Cement Bins Cement Storage Elevators Conveyors Ready Mix Plants Expressway Semi-Portable Plants Dry Batch Plants

Manufactured by

L. BURMEISTER CO. 4535 W. Mitchell, MILWAUKEE 14, WIS.



extra white

TRINITY WHITE
Portland Cement

Use Trinity—the *whitest* white cement. A true portland cement that meets ASTM and Federal specifications. Trinity is first choice for architectural concrete units, terrazzo, stucco, paint and other uses. Regularly advertised to architects and other factors in the industry. Gives a pure white and true colors when pigments are added. Ask for Trinity White General Portland Cement Co., 111 W. Monroe St., Chicago; Republic Bank Bldg., Dallas; 816 W. 5th St., Los Angeles; 305 Morgan St., Tampa; Volunteer Bldg., Chattanooga.

TRINITY WHITE is a *true* Portland Cement

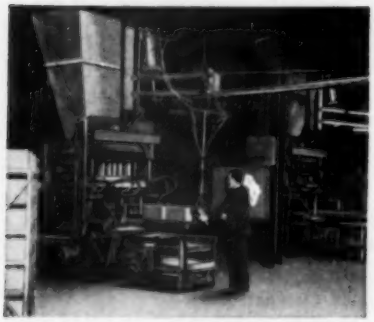
as white as snow

Get on the Map—

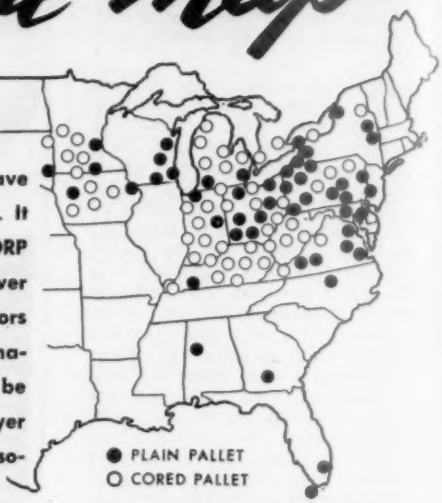
with a GOCORP

You'll be in good company. As you can see, GOCORP in three short years has effectively invaded the most competitive areas in the concrete products industry.

There must be reasons why these successful operators have modernized with a GOCORP. It boils down to this—a GOCORP makes better blocks at a lower unit cost. Also, these operators know that their GOCORP machines are old enough to be proven but so new that the buyer is protected against early obsolescence.

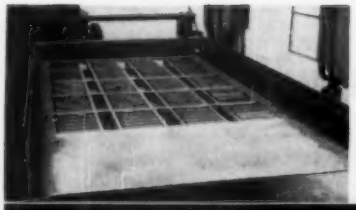


Why not write for the locations of plants near you? GOCORP owners will be happy to have you see their machines in operation and tell you of their experience.

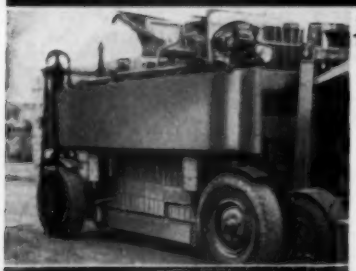


GO CORP
ADRIAN-MICH.

407 Grace St. • Phone 2120



Unloading Time... with a GERLINGER CARRIER



Kennedy Concrete Block Co., Philadelphia, was plagued with the same problem that faces most concrete products manufacturers: laborious, time-consuming unloading at customer-selected locations. This firm's solution is a GERLINGER Material Carrier, designed to drop cube loads with no manual labor or use of pallets.

The Gerlinger is equipped with a movable holding plate that is held by the carrier's shoes. Cube loads of 400 blocks are placed on the plate by the yard lift truck, and are unloaded at the customer's location by merely dropping the shoes. A push-bar shoves the load off the steel plate. Mr. Garfield Kennedy, president, says: "It takes our Gerlinger driver only three minutes to drop a load. The use of this system has speeded up our deliveries and eliminated expensive mar al handling."

For complete details, drop us a card. We'll gladly send you our free catalog showing all models of Gerlinger Material Carriers.

TOP: Movable plate equipped with four rows of rollers held in place by the Gerlinger's shoes.

CENTER: Cube loads are loaded by yard lift truck.

BOTTOM: Push-bar mechanism mounted at rear of Gerlinger, powered through a universal connection to the carrier's motor.

GERLINGER CARRIER CO.

6-311

GERLINGER CARRIER CO., DALLAS, OREGON

UNIVERSITY OF MICHIGAN LIBRARIES

THE INDUSTRY'S RECOGNIZED AUTHORITY

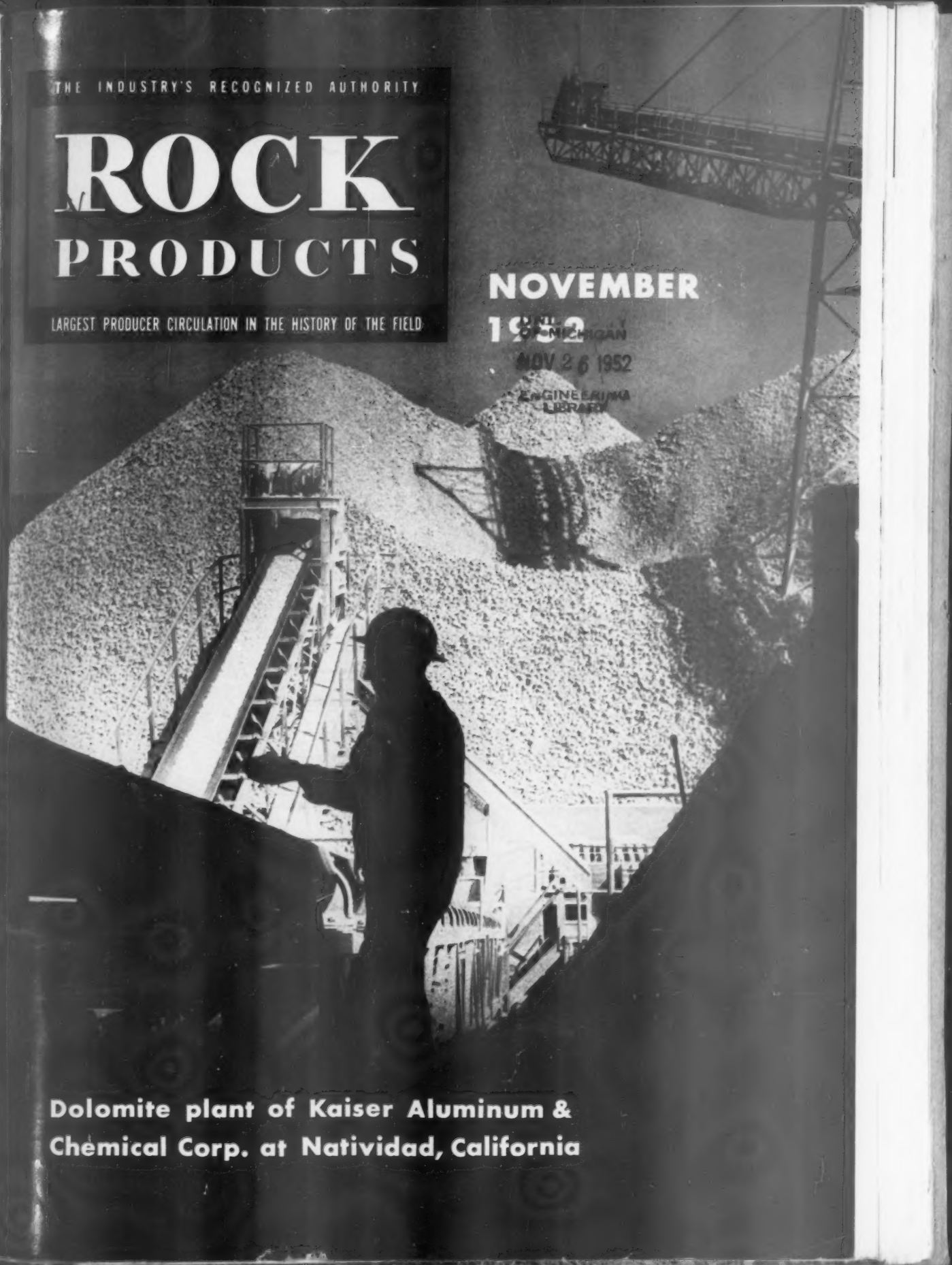
ROCK PRODUCTS

LARGEST PRODUCER CIRCULATION IN THE HISTORY OF THE FIELD

NOVEMBER

19[illegible]2

UNIV. OF MICHIGAN
NOV 26 1952
ENGINEERING LIBRARY



Dolomite plant of Kaiser Aluminum & Chemical Corp. at Natividad, California